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UPPER AND LOWER SIMMONS RESERVOIRS

DREDGING STUDY

PREPARED FOR

RHODE ISLAND SOLID WASTE MANAGEMENT CORPORATION

BY MAGUIRE GROUP INC.

JUNE 1992

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RHODE ISLAND SOLID WASTE MANAGEMENT CORPORATION

SIMMONS UPPER AND LOWER RESERVOIRS

DREDGING STUDY

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EXECUTIVE SUMMARY

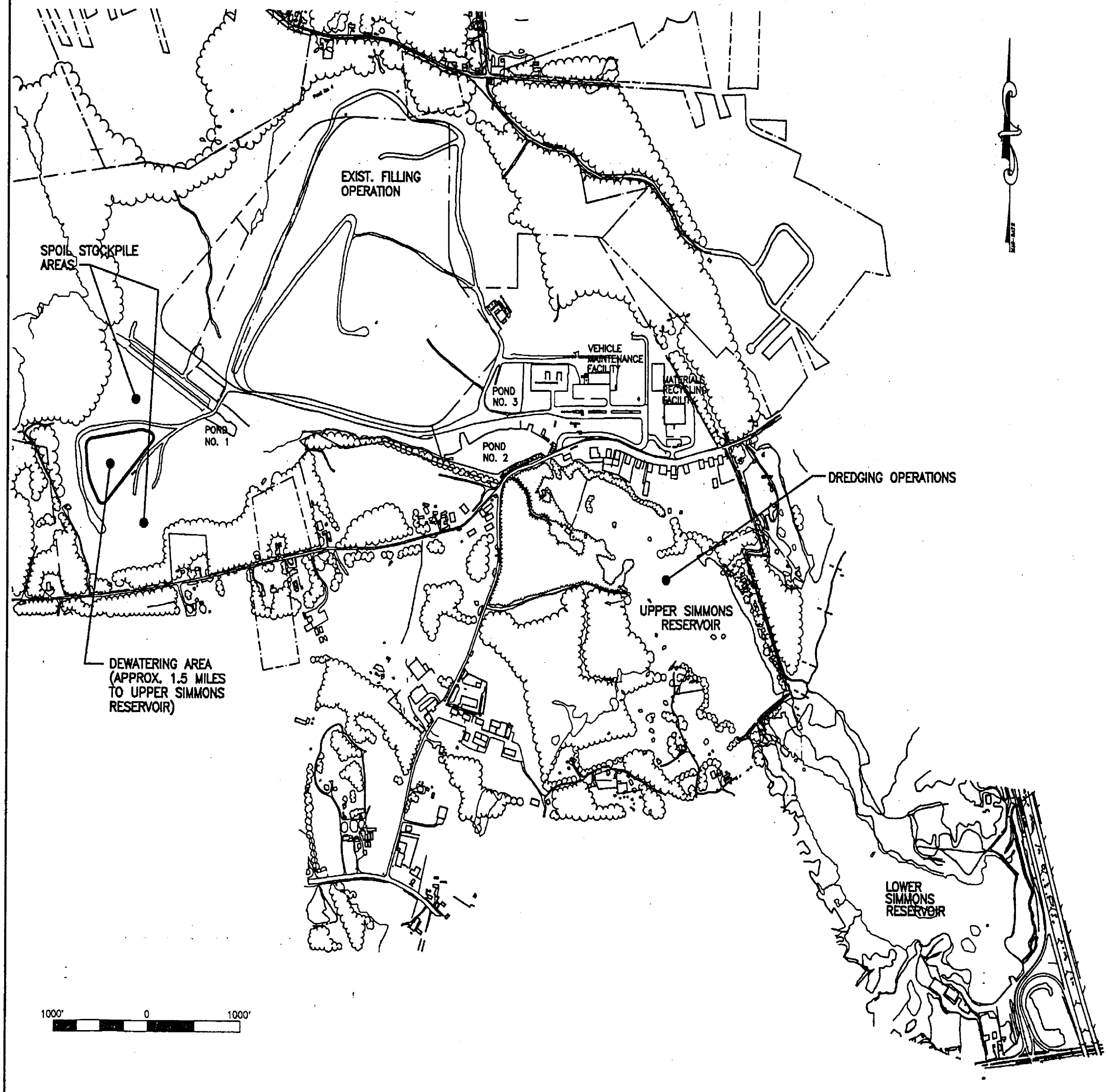
RISWMC was ordered by DEM to take corrective actions to restore specific wetlands altered by the landfill operation. The Upper Simmons Reservoir requires approximately 250,000 cubic yards of sediment removal. No observable sediment deposits were found in the Lower Simmons Reservoir and removal is not proposed.

The first phase of the plan is to remove deposited sediment from the Upper Simmons Reservoir. This report investigates the classification and amount of sediment, as well as various methods of removal. Hydraulic and mechanical methods are described along with locations of dewatering areas.

Hydraulic dredging was found to be the most efficient method of removing the type of sediment found. Dredging will be performed in a general north to south manner. As shown on Figure A, the dredged material will be pumped approximately 1.5 miles to a dewatering and spoils area located on the southwest corner of the landfill property. When dried, the dredge spoil will be used as cover material for the landfill.

The approximate time required to complete the entire dredging operation is 14 months and will cost approximately $2.9 million.

Under the Consent Agreement, prior approval from DEM is not required prior to commencing dredging. A Water Quality Certificate will be required from DEM, Division of Water Resources. Prior U.S. Army Corps of Engineers approval has expired. The Corps of Engineers has been contacted to ascertain if a further extension may be granted or if an application for a permit must be filed. As of the writing of this report, the Corps of Engineers had not made a final determination.



DREDGING OPERATION OVERVIEW

FIGURE A

I. INTRODUCTION

A. AUTHORIZATION

This study has been developed for Rhode Island Solid Waste Management Corporation (RISWMC) to address portions of the work required in the Rhode Island Department of Environmental Management (DEM), Revised and Amended Consent Agreement, dated July 24, 1991. The focus of the study is the required work described in Part III of the Agreement which pertains to the removal of accumulated inorganic sediment deposited within Cedar Swamp Brook and Upper Simmons Reservoir and the determination of the location and extent, if any, of inorganic sediments in Lower Simmons Reservoir.

B. BACKGROUND

RISWMC was notified by DEM of an alleged violation of the Rhode Island Freshwater Wetlands Act (R.I.G.L., Section 2-1-21) in March of 1985. The Notice of Violation stated that RISWMC had caused wetlands on and adjacent to the site of the RI Central Landfill to be altered without the permission of the Director of DEM as required by the Freshwater Wetlands Act. RISWMC was ordered to take certain corrective actions and to pay an administrative fine. RISWMC agreed to resolve the violation in a Consent Agreement executed in November of 1986. In April of 1989, DEM issued a Notice of Intent to Enforce the Freshwater Wetlands Act and required RISWMC to take specific actions to stop alterations and submit necessary reports and studies relating to the restoration of wetlands. RISWMC agreed to take the necessary actions in an amended Consent Agreement in July of 1989. Subsequent to that time, DEM required an amended Consent Agreement as a condition of approval for a permit for landfill expansion. This plan responds to the requirements of the revised and amended Consent Agreement which pertain to the removal of sediments in those bodies of water and surrounding wetlands listed above.

The operation of the landfill requires continuous and extensive soil disturbance for landfilling, grading, excavation and placement of cover material, disposal of unsuitable soils (especially boulders), stockpiling, composting, and construction of landfill related facilities. Major portions of the site (over 300 acres) are presently open for excavation related to landfill operations and the expansion of landfill capacity. The substantial amounts of fine sediments deposited in site drainage structures indicate that the soils on the site are silty and clayey. This type of soil is very vulnerable to erosion. Worse, once these types of soils are eroded they are easily transported and settle out of suspension very slowly.

The construction of erosion control structures and other measures taken since the RISWMC and DEM entered into the initial Consent Agreement appear to have had some impact on the amount of material reaching the downstream areas. It is clear, however, that despite the efforts of RISWMC, erosion and sedimentation problems persist at the landfill site. The continued transport of fine-grained silt and clay-sized particles from the site to downstream wetlands, water courses and water bodies has resulted in the degradation of water quality and the determination by DEM that there is an ongoing violation of the Freshwater Wetlands Act.

This report is the first phase of a plan to remove the accumulated sediment from the affected areas and to restore those areas to a state approximating their condition prior to the disposition of the materials.

The effective removal of those materials by dredging or excavation and its subsequent handling, treatment and transport are the issues discussed herein. Beyond the scope of this report are the measures required to curb further sedimentation and to resolve other outstanding sedimentation and erosion control issues. Primary among the outstanding issues is the drainage channel or "chute" on the southeast face of the existing landfill. This chute is a continuing, major source of sediment.

II. SEDIMENT SOURCES

A. CENTRAL LANDFILL

As noted above, ongoing landfill operations on the site require extensive earth moving activities. These areas constitute the primary sources of sediments entering the Upper Simmons Reservoir.

Maguire Group prepared "Working Operational Erosion and Sedimentation Control Plan," October 22, 1991, for RISWMC. This plan identified seven focal areas on the landfill site which are characterized by disturbed, erodible, non-vegetated and non-stable soils. The following information is summarized from the plan and is listed in order from those sources considered to be the most significant to those considered to be the least significant sources of sediment:

- **The "chute"** down the southeast face of the landfill which is an unstabilized waterway subject to large volume, high velocity flow.

- **The excavation area** in the southwestern corner of the landfill property where cover material is being extracted and various earth and rock materials are stockpiled.

- **The west face of the landfill,** a steep, unstabilized slope with a very large surface area subject to erosion.

- **The quarry,** an open area west of the landfill within which a stream flows along a poorly defined channel which meanders over unstabilized soils.

- **The eastern faces of the landfill,** steeply sloping areas of unstabilized soil subject to severe hill and occasional gully erosion.

- **The boulder disposal area** east of the landfill where boulders extracted during cover material excavation are stockpiled and buried.

In addition to the sources of sediment listed above, a "Planned Activity Areas" category of potential sediment sources has been identified. This category consists of areas where planned activities will result in soil disturbance (see "Rhode Island Central Landfill Working Operational Erosion and Sedimentation Control Plan," dated October 22, 1991). These include:

- **The "Bowl" Area of the Landfill** where solid waste will continue to be placed, compacted and covered over,

- **The Top and Southeast Faces of the Landfill** where solid waste will be placed, compacted and covered over to bring the surface to final elevation and then closure will be accomplished,

- **The Expansion Area** where construction of the leachate collection system, the base liner subgrade and the interface liner will be accomplished,

- **The Excavation Area** in the southwest corner of the site where cover material removal activities will continue,

- **The Quarry Stream Channel** where earthwork and blasting will relocate existing stream flow westward, outside the landfill expansion area,

- **Stockpile and Compost Areas** where cover material, fill for construction of the landfill expansion, and loam will continue to be stockpiled and compost operations will continue to be stored temporarily,

- **The Boulder Disposal Area** where boulders will continue to be stockpiled, blasted, and buried,

- **The Resource Recovery Facility Site** where construction of a new waste to energy facility is planned,

- **A Possible New Landfill Location** where a new landfill may be constructed on, or adjacent to, RISWMC property.

B. OTHER SEDIMENT SOURCES

The present turbidity levels and amount of deposited sediments in the Upper Simmons Reservoir is at extreme values. It is evident that the Upper Simmons Reservoir contains approximately 250,000 cubic yards of sediment deposits. The majority of this sediment comes directly from the landfill; however, neighboring open gravel pits and local industry also contribute to the present turbidity levels. Stormwater from these neighboring sites enters the reservoirs directly and by means of tributary streams. These areas include:

- Open borrow pit west of Upper Simmons Reservoir.

- Light industrial area northeast of Upper Simmons Reservoir, perimeter areas of exposed soil and borrow/stockpile areas.

- Active borrow pit east of Simmons Lake Drive.

- Light industrial area west of Upper Simmons Reservoir at the intersection of Shun Pike and Green Hill Road.

- Open borrow pit and composting area west of Green Hill Road.

- Open borrow pit between Green Hill Road and Upper Simmons Reservoir.

- Unstabilized soils over recently installed gas line. This poses a direct potential threat to Lower Simmons Reservoir.

- Road reconstruction and various building construction along Plainfield Pike.

As sediment sources on the landfill property are reduced and eliminated, these off-site sources will become more significant.

III. FIELD INVESTIGATIONS

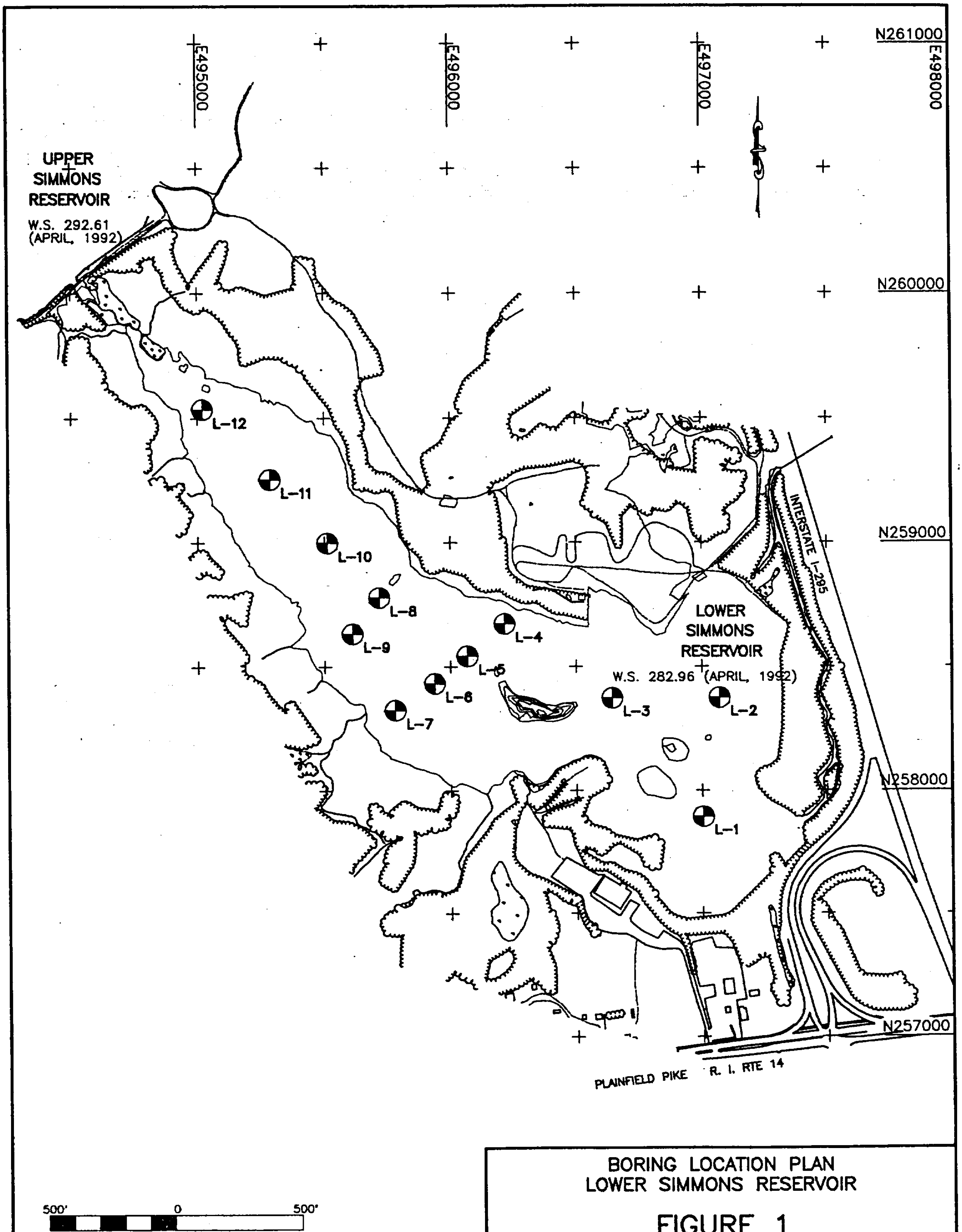
A. SEDIMENT SAMPLING PROGRAM

A sampling program was undertaken to determine the extent of reservoir sedimentation as a result of landfill cover erosion. The program's results assist in determining the extent and method of sediment removal that will be required. The program consisted of 22 borings located within the Upper Simmons and Lower Simmons Reservoirs executed during the period Monday, April 27 through Thursday, April 30, 1992. Ten borings were located in the Upper Simmons Reservoir, designated Ul through U10, and twelve borings were located in the Lower Simmons Reservoir, designated Ll through L12, see the attached boring location plans (Figures 1 and 2) and boring logs, Appendix A.

Sediment samples were obtained by Guild Drilling under the direction of an MGI engineer. An 18-foot flat bottomed steel work boat was utilized for the boring program. An "As-Sampled" location was recorded for each boring. Survey control was provided by Weiler Mapping, Inc. by landbased survey methods.

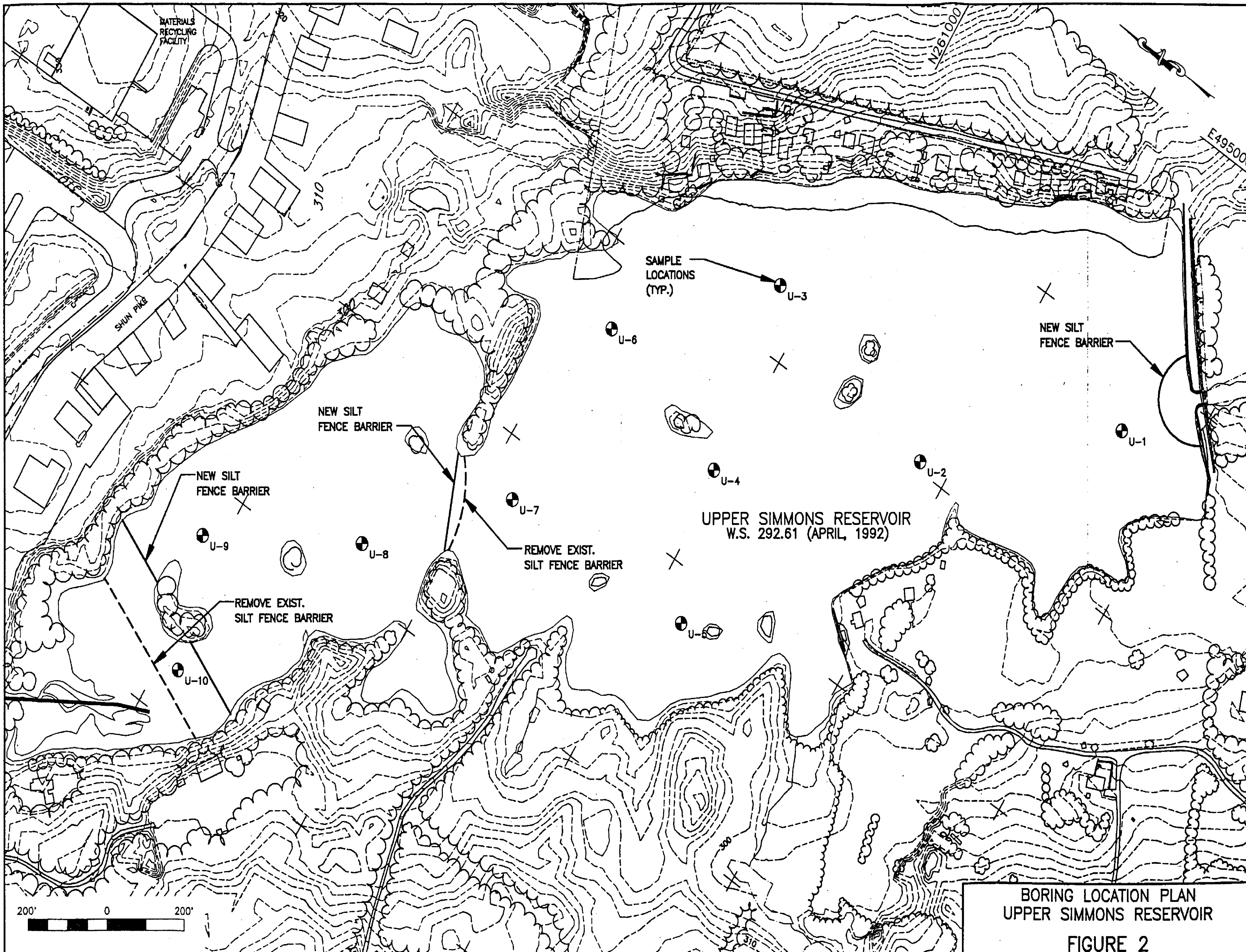
The elevation of the water surface in each reservoir was obtained by Weiler. The water surface elevations were:

Upper Simmons Reservoir	292.61
Lower Simmons Reservoir	282.96



BORING LOCATION PLAN
LOWER SIMMONS RESERVOIR

FIGURE 1



BORING LOCATION PLAN
UPPER SIMMONS RESERVOIR

FIGURE 2

B. SAMPLING METHODOLOGY

The typical sampling procedure was as follows:

- Anchor the boat at the approximate boring location,
- Lower and secure a 3-inch diameter casing to the sediment surface for multiple samplings in the same hole, as required,
- Press a 24-inch long split spoon sampler into the sediment utilizing the weight of rods and drillers,
- Depending upon the thickness of the soft sediment, either retrieve the sampler and press a second time until firm bottom was reached or in one motion press the sampler until firm bottom was reached.

The boring program was initiated at the southern end of Upper Simmons Reservoir. In the initial borings, the reservoir "firm bottom" material was sampled by driving the split spoon with a 140-lb. hammer. This method provided a sufficient sample to characterize the "original" reservoir bottom material. The remaining borings terminated at the firm bottom interface, recovering only an inch or two of the original bottom material. The difference between recent inorganic sediment and original organic material was readily distinguishable by color, texture and consistency.

The sediment samples were photographed for record purposes and to document the interface between the landfill derived silt and the underlying peat.

C. FINDINGS

In the Upper Simmons Reservoir, from the sediment surface to firm bottom typically three strata were observed. From top to bottom the observed strata were:

- Gray loose Silt (landfill sediment),
- Brown/black soft fibrous Peat, and
- Light gray, medium-dense Silty fine to medium Sand, trace fine gravel.

These three strata were distinctly quantified (on the boring logs) by their respective resistance to the sampler penetration. The recovered sample lengths generally were not indicative of the actual stratum thickness due to their extremely loose consistency, although representative material from each layer present was recovered from all sampling locations.

It is noteworthy that the surficial sediment (landfill sediment) was only observed in the Upper Reservoir. There was no landfill sediment observed at any of the borings in Lower Reservoir. The Lower Reservoir contained soft peat overlying firm bottom material in all borings. Boring L-8 contained no peat at all.

The Upper Reservoir contained much suspended silt/clay-size particles in the water as indicated by a distinct brownish color and a visibility of only several inches. By contrast the Lower Reservoir, although not clear, had a much improved visibility and only a trace of the brownish water color at the northern end. At most sample locations (water depths of about 1 to 4 feet), the bottom of the pond could be seen through the water of the Lower Reservoir.

The following is a summary of the boring information obtained from both Reservoirs. Enclosed figures 1 and 2 indicate boring locations in the Upper and Lower Reservoirs, respectively. Logs for the borings are included in Appendix A.

UPPER SIMMONS RESERVOIR Water Surface Elevation 292.61

Boring No.	Water	Depth in Feet Sed.	Peat	Location
U 1	9.0	0.5	4.8	Southern End of
U 2	9.0	3.0	1.2	Upper Reservoir
U 3	7.0	4.0	13.5	
U 4	8.0	3.0	2.0	
U 5	5.0	2.0	0.5	
U 6	5.0	1.0	0.0	
U 7	7.0	4.0	1.8	
U 8	5.5	3.5	0.5	
U 9	4.5	2.0	0.2	
U10	1.7	3.0	1.0	Northern End of Upper Reservoir

LOWER SIMMONS RESERVOIR Water Surface Elevation 282.96

Boring No.	Depth in Feet Water	Sed.	Peat	Location
L 1	2.0	0.0	1.8	Southern End of Lower Reservoir
L 2	3.7	0.0	1.8	
L 3	2.5	0.0	1.7	
L 4	1.5	0.0	1.3	
L 5	2.8	0.0	2.8	
L 6	2.0	0.0	1.8	
L 7	1.3	0.0	3.8	
L 8	1.0	0.0	0.0	
L 9	1.0	0.0	2.8	
L 10	1.0	0.0	3.3	
L 11	1.5	0.0	3.3	
L 12	0.8	0.0	3.8	Northern End of Lower Reservoir

The results of the program confirms the entire Upper Reservoir contains levels of deposited sediment ranging from 0.5 feet at the southern end to in excess of 5 feet in the north. The extent of organic deposits beneath the sediment layer were found to be deeper than expected with an average depth of 2.5 feet. The original organic bottom material was found to be both deeper and softer than expected. Total quantity of sediment deposits determined by the depth of sediment for the entire reservoir = 2.5 feet + 6", overdredge = 3 feet. 3 feet x 51 acres x 43,560 ft./acre ÷ 27 = 246,840 cubic yards.

The Lower Reservoir was found to have no observable layer of recent inorganic sediment above the original reservoir bottom. No action needs to be taken to remove sediment from the Lower Simmons Reservoir.

Prior sampling studies were taken in the Upper Simmons Reservoir. A chemical analysis of these samples was conducted and the results, located in Appendix C, indicate the amounts of contaminants contained in the samples.

IV. DREDGING METHODS

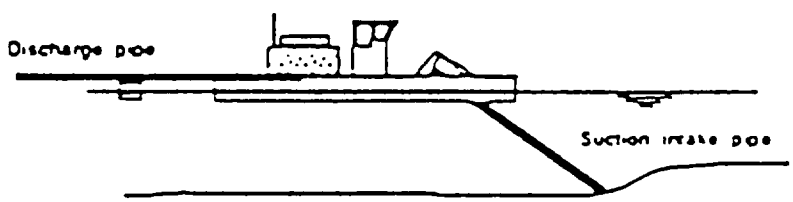
A. OPTIONS

Removal of the accumulated inorganic sediments from the affected water body could be accomplished in a number of ways, with the most effective program possibly resulting in the use of different methods and technologies in different areas. The basic task, whether completed in submerged or exposed land, is one of excavation. Traditional earthmoving equipment (backhoes, shovels, crane-mounted clamshells) can be effectively utilized in areas where the sediments to be removed are of substantial thickness and firm composition. Earthmoving equipment has the advantage of the removal of a high concentration of solids and little water. This method would be feasible where the material to be excavated is primarily sand and gravel, or where it is sufficiently dense to be removed in a cohesive mass. The only portion of the project area where this may be the case is at the delta formed at the northern extreme of the Upper Simmons Reservoir, and the portion of Cedar Swamp Brook between the Reservoir and Shun Pike. In the remaining Upper Reservoir, where the sediment layer is thinner and consists primarily of soft silt and clay-size particles, a small floating hydraulic dredge may work most efficiently.

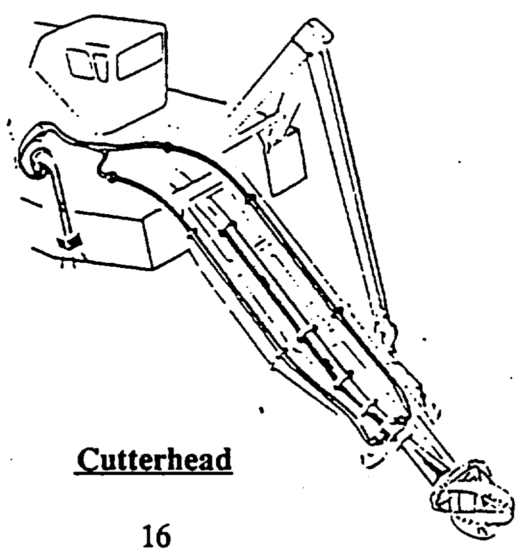
1. Hydraulic Dredging Methods

Hydraulic dredges employ centrifugal pumps to create suction in a pipeline which lifts sediments from the waterway bottom. Typically, mechanical means are employed at the head of the pipeline to disturb or loosen bottom sediments which are then pumped in the form of a slurry. The content of the slurry may be as much as 80 to 90% water and only 10 to 20% sediment. Dredging techniques and the various types of equipment available are discussed in more detail and are shown in sketches below.

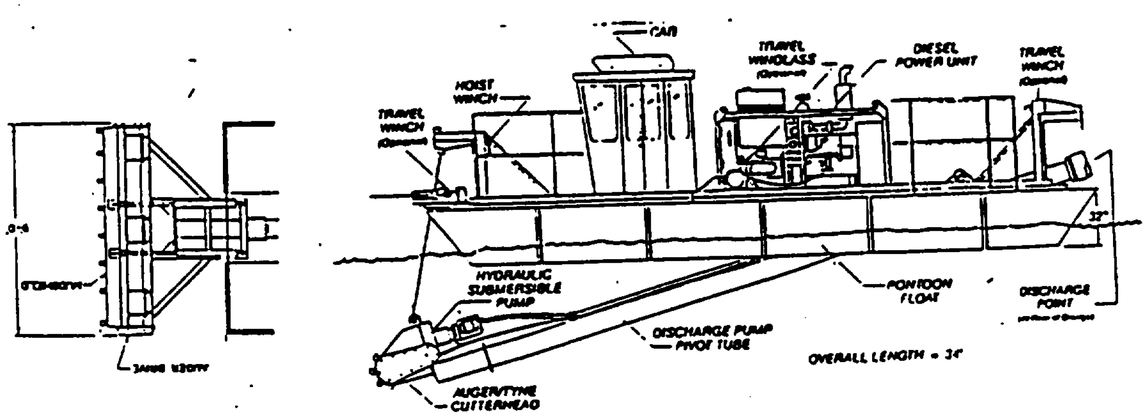
Three general hydraulic dredging methods are plain suction, cutterhead and horizontal auger, as shown below.



Plain Suction



Cutterhead



Horizontal Auger

The plain suction hydraulic dredge uses the suction developed by a centrifugal pump to lift the slurry of water and material through a pipeline from the bottom, relying solely on the velocity of the incoming water to loosen and remove bottom material. The suction line is supported by a boom or "ladder" which is raised, lowered and laterally controlled from the floating dredge. The suction line typically has, at its intake end, a screened bell--shaped nozzle to protect the pump and increase efficiency. This type of hydraulic dredge is designed to dredge loose sands and silts and is not suitable for compacted materials.

The cutterhead hydraulic dredge employs essentially the same suction system, except that an electrically or hydraulically driven rotating cutterhead is located at the intake end of the suction line. The cutterhead "chews up" the material, thus enabling the dredge to excavate harder materials than the basic suction type. Variations in the design of the cutterhead allow the dredge to excavate most types of material efficiently. Because the most versatile of the hydraulic dredges is this cutterhead type, it is the type owned by many dredging contractors having large hydraulic dredges. Small road-transportable dredges may also be equipped with cutterheads.

Horizontal auger dredges are used on small, road-transportable dredges. The horizontal auger dredge generally has a wide flat "dustpan" shaped intake structure with a laterally mounted rotating cutter which dislodges material and feeds it to the suction line at the center. The auger is lowered to a specified depth and cuts a swath as the dredge is moved forward.

Hydraulic dredges are typically categorized in size by suction line diameters which range from 6 to 32 inches. For this project, a line diameter of 8 inches is anticipated. Typically, material dredged hydraulically is transported via a pipeline to either a nearby barge for disposal, or to a nearby landside containment area for dewatering. Dewatering and disposal methods are discussed later in this report.

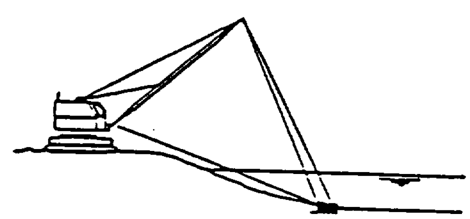
Production rates for hydraulic dredging are highly variable and are a function of the type and consistency of material being excavated, depth of dredging, disposal method, pumping distance and dredge characteristics, such as suction line diameter and pump horsepower. Production rates are also dictated by the size of the containment area for dewatering or other disposal limitations.

Hydraulic dredges generate little turbidity in the water at the dredge location as the dredging action tends to pull this water into the suction line. However, they do generate large volumes of silt-laden water which must be cleaned at the dewatering area before being returned to a natural water body.

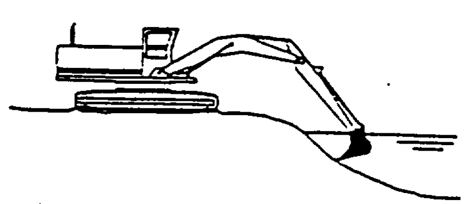
2. Mechanical Dredging Methods

Mechanical dredging is simply the use of standard earth excavation equipment for the removal of submerged soil. If the area to be dredged is within reach of shore, little adaptation in equipment is required. Two types of equipment generally employed for shoreline mechanical dredging operations are the backhoe and dragline, as shown below. The backhoe may be modified with an extended arm to reach further out from the shoreline to remove soil.

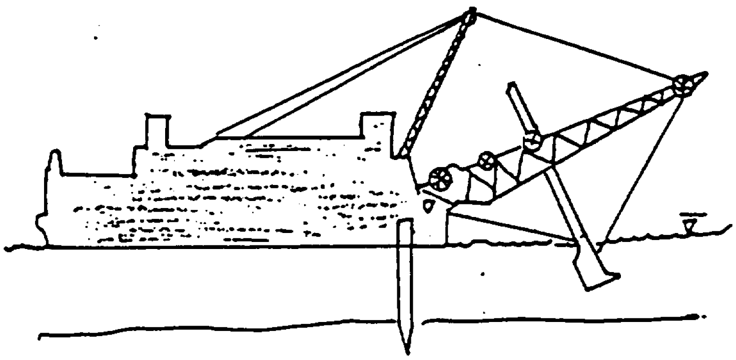
The dragline is an open shovel or scoop suspended from a crane boom. The shovel is lowered to the bottom and dragged toward the crane, filling with scraped material as it travels.

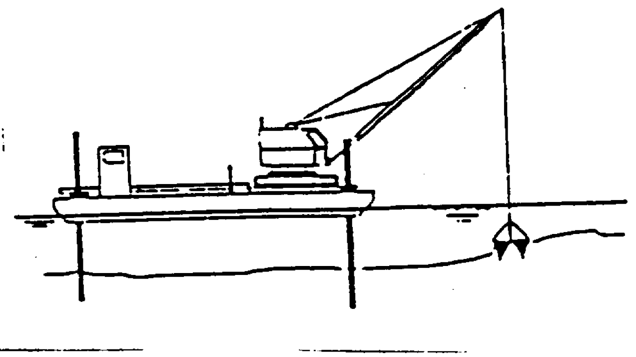


Dragline crane working from shore



Tracked backhoe working side slope





<u>**Dipper**</u> <u>**Clamshell**</u>

For mechanical dredging of areas away from shore, both the backhoe and dragline could be utilized as well as a dipper and clamshell dredges. Any of these methods would require barge mounting so as to be easily moved about on the water body. A dipper dredge is similar to the backhoe, but excavates on an outward lifting motion rather than back towards the operator as a backhoe does. This dredge is effective in removing cemented sediments and other firm materials such as glacial till, boulders, and blasted rock. The depth of dredging is limited by the length of the shovel arms. A clamshell is an open bucket mounted to a crane or a barge and lowered vertically to the soil. It is a proven and effective means of removing a large range of sediment types.

The dredged material from mechanical dredging may be deposited directly to a truck on shore or onto an adjacent barge. This barge is transported back and forth between the dredge area and a rehandling area on shore.

Mechanical dredging is common for dense soils, large quantities, thick layers, deep water, and for pier-side dredging. It is also used when site constraints severely limit the area available for dewatering, as the solids-to-water ratio for mechanical dredges is much higher than for hydraulic dredging, therefore eliminating or reducing the dewatering area.

Unlike hydraulic dredging, mechanical dredging may produce significant amounts of turbidity of the dredge location. This turbidity is difficult to contain or control.

3. Draining Upper Simmons Reservoir

Consideration was given to removal of sediment from Upper Simmons Reservoir in the dry utilizing standard earthmoving equipment. This would require draining of the reservoir. Historically, the two reservoirs have been periodically drained to accommodate the needs of the mills downstream, using them as a source of process water. Unfortunately, the organic sediments underlying the soils to be dredged are too soft and thick to support earthmoving equipment. Therefore, this option of sediment removal is not a practical alternative.

The preferred routing of a dredge pipeline from Upper Simmons Reservoir would be along Cedar Swamp Brook. The adjoining property is not owned by RISWMC, and thus far the owners have not agreed to allow easements. As an alternate, a much longer and more costly routing could be through RISWMC owned property on the east side of the reservoir. The pipeline would go north along the west shoulder of Simmons Lake Drive. The pipe would require burial to cross Shun Pike before heading west toward RISWMC property. If the easement is granted, the pipeline and dredging of the brook would result in some disturbance of wetlands in that area.

The delta which has formed in the Upper Simmons Reservoir at the mouth of Cedar Swamp Brook contains a thick deposit of sand and gravel, as well as fine-grained soils. Portions of this delta are accessible from shore. Because of this, large amounts of the delta could be effectively removed with a backhoe or dragline from shore. A dragline would be capable of reaching out 60 to 70 feet. This material excavated would require little or no dewatering and could be deposited directly into dump trucks and hauled to the landfill for cover material. However, the shoreline of Upper Simmons Reservoir adjacent to the delta is not owned by RISWMC, making this method of dredging impractical.

B. PROPOSED DREDGING METHODOLOGY

A horizontal-auger dredge would probably prove to be the most efficient means, since most of the dredging will involve the removal of a relatively thin layer of sediment from the existing bottom. Some specifics of the dredge which should be employed are:

1. Approximate rated dredge pump capacity of 2,000 gallons per minute.
2. Draft - no more than 21 inches.

3. Approximate suction pipe diameter - 8 inches.

4. Approximate discharge pipe diameter - 8 inches.

A hydraulic dredge of this type would be road-transportable and could be launched by crane from RISWMC owned property on the east shore of Upper Simmons Reservoir, resulting in minimal disruption to surrounding wetlands. The configuration of the majority of Upper Simmons Reservoir, combined with the depth and type of sediment, do not lend themselves to efficient dredging by mechanical means. A road-transportable, horizontal-auger hydraulic dredge is judged to be the appropriate choice. These dredges are available in a variety of sizes that can be transported on a trailer and offloaded with a crane. Many dredges can work in less than 2 feet of water with the capability of dredging to a depth of 15 feet. Both are reasonable limits for this project. The 8-inch discharge pipeline from the dredge to the spoil area would be floated on the reservoir to Cedar Swamp Brook. From there, it would run along the brook, through the culvert at Shun Pike, and then over land to the dewatering area. The length of pipeline from the southernmost point on the Upper Simmons to the dewatering area will be about 1 1/2 miles and the difference in elevation from dredge to discharge will be about 80 feet. This will necessitate the use of at least one booster pump somewhere along the pipeline to maintain adequate flow velocity. The location and number of booster pumps will be dependent upon the actual equipment selected by the Contractor.

As stated earlier, in addition to the equipment utilized, the dredge rate is controlled by the size of the containment area and/or the dewatering process. A horizontal auger dredge with an 8-inch discharge line is estimated to be capable of removing 180 cubic yards of sediment per hour. This quantity is higher than that of the same dredger in gravelly or sandy conditions due to the soft silty sediments encountered. Usually, the dredgers operate at a 4 to 1 water to soil ratio. However, with the soft sediments being dredged, it may be possible to achieve a 1.5 to 1 ratio. This will make the operation more efficient and reduce the dewatering process.

C. FIELD CONTROL

Control of the dredging operation will require setting several points around the perimeter of the reservoir for vertical and horizontal control. The location of the dredge can be determined by optical and/or electronic survey equipment at control points on-shore.

Because of the high turbidity in the Upper Simmons Reservoir and the condition of the extremely soft sediment, manual inspection or accurate soundings of the bottom cannot be made. Therefore, dredge depths have been estimated based on the sediment data collected. To set actual dredging depths, it will be required that the dredging contractor perform numerous probes and take samples as the dredging progresses. In this manner, limits can be determined at the time of dredging.

D. TOLERANCES

Dredging tolerances vary with the type of dredge and the quantity being removed. Dredging is typically conducted to a uniform elevation over a given area. A hydraulic dredge would be set to a predetermined depth and would remove all material to that elevation. To accomplish the removal of inorganic sediments from Upper Simmons Reservoir, the dredge must be adjusted to dredge to the depth of the top of the organic layer. From a practical standpoint, there are no commercially available dredges that are able to follow bottom contours and remove varying thicknesses of material. The minimum depth of material able to be removed by available equipment about 6 inches, with a practical minimum tolerance of ±6 inches. If the bottom elevation varies significantly in a small area, the dredge must be set at the lowest elevation. The resulting thickness of organic material removed will also vary accordingly.

The tolerance set forth by the DEM consent agreement requires the removal of any sediments with 1-inch depth or greater. As all sample locations in the Upper Reservoir encountered at least 1/2 foot of sediment, the minimum thickness to be removed appears to be compatible with the anticipated equipment. However, there will be a significant problem associated with controlling the amount of natural, organic sediments that will be removed to assure complete removal of the landfill sediments.

The consent agreement states that:

> "Dredging shall be to the original organic material beneath the deposited inorganic material and substantial efforts will be made not to exceed a depth more than six (6) inches below the inorganic/organic interface encountered during dredging operations."

This restriction will be difficult to comply with for several reasons. First, the vertical accuracy of the dredging equipment is about the same as the stipulated limit. Therefore, to assure complete removal of the inorganic sediment, with an equipment accuracy of ±6 inches, it can be expected that at a minimum zero to 12 inches of organic material will be removed with the average amount removed being at least 6 inches.

Several steps will be taken to limit the extent of overdredging. The top surface of the inorganic sediment will be determined by physical and/or acoustic soundings. The top of the underlying organic layer will then be determined by physical probings. Samples will also be taken periodically to verify the methodology. Based upon the results of the probings, a dredge depth will be established for the surrounding area. The extent of area to be dredged to a set elevation will depend upon the variability of the surface of the underlying organic layer.

Verification of the removal of inorganic sediment will be done by taking additional, post-dredge soundings and samples.

V. DEWATERING AND DISPOSAL METHODS

A. MECHANICAL SYSTEMS

There are several mechanical package systems available which, through a series of physical and chemical means, will dewater and consolidate solids from a slurry and produce a clear filtrate and a spoil material which is sufficiently dry to handle, truck and spread. The configuration of the systems are dependent upon the area available and materials being handled. Typically, these systems are made up of a combination of hydrocyclones, centrifuges, belt presses, or filter presses. Chemical additives such as flocculants may be added at some time during the process to accelerate the separation of solids and water.

Sand and coarse-grain materials can be separated out in the hydrocyclones or centrifuges. For finer materials, filter presses or belt presses are required. Filter presses utilize high operating pressures and filtering media to separate liquid from the slurry, producing a filter cake and a clear filtrate. The filter cake is typically dry enough to be transported in open trucks and be used on the landfill immediately.

The advantages to a mechanical dewatering system are twofold. First, the process is much quicker than traditional dewatering and drying in a basin. Second, space requirements are minimal compared to that required for a dewatering basin. A system capable of processing 1,200 gallons of slurry per minute would take up an area roughly

40 feet by 100 feet. If greater production rates are required, multiple system installations can be provided.

The major drawback of this procedure is the cost. The price per cubic yard to mechanically dewater dredge spoil is about twice that of the cost of utilizing more conventional dewatering basins. As a result, these systems have historically only been used where space limitations prohibit conventional settling basins for dewatering. Since area is available for dewatering basins, it is anticipated that mechanical methods will not be used.

B. DEWATERING AREA

An area designated for the purpose of separating the water from the dredge spoils and sediments must be located upland of the Upper Simmons Reservoir. The average dredge discharge is anticipated to consist of approximately 80% water and 20% sediment. This requires a substantial area and volume to both contain spoil material and act as a sediment pond. To accomplish this, two dewatering basins will be excavated adjacent to each other. Each will be large enough to accommodate over 25,000 cubic yards of spoil and sediment to allow settlement of suspended sediments. Each basin flows into a secondary settling pond to increase settlement of suspended silt and clay sediment. Check dams and siltation barrier baffles will be provided to increase settlement and control outfall turbidity. The proximity of the two basins to each other will allow easy movement of the discharge pipe to enable alternate cleaning of the basins as they fill. Each basin will be allowed to fill three-quarters full with sediment before the discharge pipe is moved. This should occur after approximately two weeks of efficient dredging. It will then be allowed to dry for approximately 4 days to allow mechanical equipment to remove the sediment and stockpile it in nearby areas for future use.

Dredge spoil material, once dewatered, is to be utilized as cover material for the landfill. Therefore, the location of the dewatering area becomes a function of its proximity to both the Upper Simmons Reservoir and the landfill.

Physical constraints affecting the dredge pumping operation are vertical rise above the dredge machine, distance to dewatering pond and available area. Several locations for the dewatering area were considered, including some not owned by RISWMC. These privately owned sites were remote from the filling operation, making hauling of spoil more costly. Additionally, RISWMC decided not to consider these outside areas due to the probable costs and difficulties associated with obtaining the necessary easements. Sites considered on RISWMC property did not offer the necessary acreage or were in conflict with proposed or on-going activities at the landfill.

The location chosen at the southwest corner of RISWMC property appears to be the most practicable for the dewatering area. There are over 14 acres available, sufficient for the dewatering operation. Access is provided by existing landfill haul roads. Pumping distance from the reservoir is approximately 1.5 miles, and the elevation rises 80 feet above the reservoir surface. The dredge piping can be laid along the side of existing roads and within existing drainage paths and culverts at road crossings eliminating any impact on traffic or landfill operations. The location of the dewatering area on the southwest corner of the landfill makes it efficient for hauling dried dredge spoil to the landfill for covering operations.

C. FLOCCULANTS

Flocculants can be added to help reduce turbidity in the watering areas by settling out suspended particles which would normally stay in suspension. One such flocculant which has been used in this capacity is alum. Alum $A1_2(SO_4)_3$ (Aluminum Sulfate) can be added in a liquid form to the dewatering ponds.

The alum combines with the suspended solids, increasing their weight and causing them to settle. It is usually applied at a 1 to 10,000 ratio by a sprayer boat or by hand.

Application of 100 gallons of alum to the dewatering basin each night after the operation stops should decrease turbidity in the outfall water greatly. Approximately 20,000 gallons of alum would be required for the duration of the project.

VI. EASEMENTS

One easement will be required for cleaning of the brook for routing of the dredge spoil pipe along Cedar Swamp Brook, from Shun Pike to the Upper Simmons Reservoir. To accomplish this work, a 40' wide easement is required through Plat 31, Lot 006. The property is not owned by RISWMC, and thus far the owner has not agreed to provide an easement. As an alternate, a much longer and more costly routing could be used through RISWMC owned property on the east side of the reservoir, and then follow Simmons Lake Drive and cross Shun Pike to enter the landfill property at the southeast corner near the Materials Recycling Facility. Permission would be required from the Town of Johnston for this routing.

Equipment access to the Upper Simmons Reservoir can be via property owned by RISWMC on the southeast shoreline of the reservoir.

VII. SCHEDULE

The scheduling for the entire operation is dictated by the capacity of the dredge. A hydraulic horizontal auger dredge with a 2,000 gal/min. pump will enable removal of approximately 1,440 cubic yards of sediment per day.

Making allowances for downtime, moving and other factors affecting the production rate, it is estimated that an average production rate of 1,000 cubic yards of sediment can be dredged per day. For the total 250,000 cubic yards of dredging estimated, this equates to 250 working days or 12 months of actual dredging. With mobilization and demobilization, a total project duration of 14 months is estimated.

VIII. COST ESTIMATE

The costs incurred in completing the entire dredging and dewatering operation is broken down into five major items as follows:

Mobilization - includes complete setup and breakdown of dredger, excavation equipment, and plant and all administration offices. Administration and Engineering supervision fees. Restoration of work areas.	$50,000
Discharge Piping - includes all labor and material involved in setting up the 8-inch discharge pipe from the Upper Simmons to the dewatering area.	$16,000
Dredging Upper Simmons Reservoir - includes dredging plant daily operation and labor, soundings, sampling, as well as dewatering personnel.	$1,500,000
Dewatering Area - includes all material and labor required for the construction of the dewatering area, maintenance and bi-weekly cleaning.	$699,200

Siltation Fences - includes all materials, installation and maintenance of siltation fences within the Upper Simmons Reservoir. $19,000

The total cost of the above items, plus 10% profit, 10% overhead, and 5% contingency is $2,855,250. Refer to cost estimate in Appendix B.

IX. CONCLUSION

The Lower Simmons Reservoir was void of any observable sediment deposits and requires no dredging. Removal of sediment deposited in the Upper Simmons Reservoir as a result of the landfill erosion will require the dredging of approximately 250,000 cubic yards.

Sediment sources other than the landfill were also found to contribute to the present levels situation, although the extent of their contribution was not determined. These outside sources include borrow pits and unstabilized soil areas in close proximity to both Upper and Lower Simmons Reservoirs. RISWMC is continuing an aggressive erosion and sediment control program. As the total amount of sediment is decreased, the off-site sediment sources will appear to be more significant.

The primary source of sediment from the landfill is the "chute". Soil stabilization and permanent drainage structures need to be installed at the chute if future dredging of the reservoir is to be avoided. Present measures being installed that will help prevent future sedimentation include:

- Vegetation of existing landfill to reduce runoff and erosion.

- Connection of pond 4 to present drainage discharge paths:

- New expansion of the landfill will reduce runoff from the north end of the Quarry Stream Valley.

- Relocation and stabilization of Quarry Stream.

Sediment removal in accordance with the tolerances set forth by the DEM Consent Agreement, dated July 24, 1991, appears impractical. The required removal of 1 inch thickness of sediment is not feasible for any commercially available equipment. A 6-inch minimum depth is more probable. Some dredging of the existing organic strata beneath the sediment will occur. Field controls will be implemented to minimize the amount of natural sediments removed.

Due to the quantity, required tolerance and type of sediment encountered, it appears that hydraulic dredging would be the best method of removal. A hydraulic horizontal auger dredge that can operate in shallow water should be employed to remove the sediment from the Upper Simmons Reservoir. The dredge should contain the following specifics:

1. 2,000 gallon per minute dredge pump
2. 21-inch draft
3. 8-inch suction diameter
4. 8-inch discharge pipe diameter

The dredge should be capable of dredging to a required depth over a specified area located by optical and/or electronic survey equipment. Dredge depths throughout the entire Upper Simmons Reservoir will be determined by the Contractor following an extensive sampling and sounding program.

Mechanical machinery may be used from Shun Pike along Cedar Swamp Brook to the northern end of the reservoir. A 40-foot easement is needed from the Shun Pike to the reservoir along assessor's plot 31, lot 2 (Tillinghast) and lot 6 (Sylvestri) to allow for the dredge discharge pipe and to allow cleaning of Cedar Swamp Brook.

The dredge material will be excavated from the bottom of the reservoir and pumped approximately 1.5 miles upland to a dewatering and spoil area located at the southwest corner of the landfill property. The dredge discharge piping route will follow Cedar Swamp Brook, go beneath Shun Pike in the existing culverts, and then follow the existing landfill roads.

The dewatering basins will utilize check dams and silt barriers. Flocculants are recommended to keep the turbidity of effluent from the basins to a minimum. The basins will be cleaned periodically to ensure proper functioning. The outlet water from the spoils area will enter existing sedimentation Pond 1, and then flow via Cedar Swamp Brook to existing sedimentation Pond 2. The entire dredging operation should have minimal effect on daily landfill operations.

APPENDIX A

BORING LOGS

GUILD DRILLING CO., INC.
100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc.	ADDRESS Foxboro, Mass.	HOLE NO. U-1
PROJECT NAME Pond Sediment Investigation	LOCATION Johnston, R.I.	PROJ. NO.
REPORT SENT TO above	OUR JOB NO. 92-156	SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.	DATE	
At ______ after ____ Hours	Type	BW	S/S		Start	4/28/92
	Size I.D.	2-1/2"	1-3/8"		Complete	4/28/92
At ______ after ____ Hours	Hammer Wt.		140#	BIT	Boring Foreman	Paul Brescia
	Hammer Fall		30"		Inspector/Engr.	Dave Nacci

LOCATION OF BORING On Water, Simmons Upper Reservoir, 9' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./ Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-4.5	D	Pushed					Gray SILT, Landfill Sediment	1	54	24
								0.5	Dark Brown sandy PEAT	1A		
5												
		5.3-6.8	D	6	8	8		5.3	Gray silty fine to medium SAND	2	18	18
								6.8	Bottom of Boring 6.8'			
									Note: 0.5' Landfill sediment observed/estimated			

GROUND SURFACE TO Top of Mud USED BW CASING: THEN Spoon to 6.8'

Sample Type	Proportions Used		140 lb. Wt x 30" fall on 2" O.D. Sampler					SUMMARY:
D=Drive C=Cored W=Washed	trace	0 to 10%	Cohesionless	Density	Cohesive	Consistency		Earth Boring 6.8'
UP=Fixed Piston UT=Shelby Tube	little	10 to 20%	0-10	Loose	0-4	Soft	30 + Hard	Rock Coring
TP=Test Pit A=Auger	some	20 to 35%	10-30	Med. Dense	4-8	M./Stiff		Samples 2
OE = Open End Rod	and	35 to 50%	30-50	Dense	8-15	Stiff		HOLE NO. U-1
* 300# hammer			50+	Very Dense	15-30	V-Stiff		

GUILD DRILLING CO., INC.

100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc.
PROJECT NAME Pond Sediment Investigation
REPORT SENT TO above

ADDRESS Foxboro, Mass.
LOCATION Johnston, R.I.
OUR JOB NO. 92-156

HOLE NO. U-2
PROJ. NO.
SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.		DATE
At ___ after ___ Hours	Type	BW	S/S		Start	4/28/92
	Size I.D.	2-1/2"	1-3/8"		Complete	4/28/92
At ___ after ___ Hours	Hammer Wt.		140#	BIT	Boring Foreman	Paul Brescia
	Hammer Fall		30"		Inspector/Engr.	Dave Nacci

LOCATION OF BORING On Water, Simmons Upper Reservoir, 9' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-4.2	D	Pushed					Gray Brown SILT, Landfill Sediment	1	50	22
								3.0	Dark Brown sandy SILT	1A		
		4.2-6.2	D	5	7	8 10		4.2	Gray fine to medium SAND & Gravel, some coarse sand	2	24	13
5												
								6.2	Bottom of Boring 6.2'			
									Note: 3.0' Landfill sediment observed/estimated			

GROUND SURFACE TO Top of Mud Line USED BW CASING: THEN Spoon to 6.2'

Sample Type	Proportions Used		140 lb. Wt x 30" fall on 2" O.D. Sampler					SUMMARY:
D=Drive C=Cored W=Washed			Cohesionless	Density	Cohesive	Consistency		Earth Boring 6.2'
UP=Fixed Piston UT=Shelby Tube	trace	0 to 10%	0-10	Loose	0-4	Soft	30 + Hard	Rock Coring
TP=Test Pit A=Auger	little	10 to 20%	10-30	Med. Dense	4-8	M./Stiff		Samples 2
OE = Open End Rod	some	20 to 35%	30-50	Dense	8-15	Stiff		
* 300# hammer	and	35 to 50%	50+	Very Dense	15-30	V-Stiff		HOLE NO. U-2

GUILD DRILLING CO., INC.

100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc. ADDRESS Foxboro, Mass. HOLE NO. U-3

PROJECT NAME Pond Sediment Investigation LOCATION Johnston, R.I. PROJ. NO.

REPORT SENT TO above OUR JOB NO. 92-156 SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.		DATE
At ____ after ____ Hours	Type	BW	S/S		Start	4/28/92
	Size I.D.	2-1/2"	1-3/8"		Complete	4/28/92
At ____ after ____ Hours	Hammer Wt.		140#	BIT	Boring Foreman	Paul Brescia
	Hammer Fall		30"		Inspector/Engr.	Dave Nacci

LOCATION OF BORING On Water, Simmons Upper Reservoir, 7' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./ Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-6.8	D	Pushed					Gray SILT, Landfill Sediment	1	82	16
								4.0		1A		
5									Dark Brown fibrous PEAT			
		6.8-17.7	D	Pushed						2	131	18
10												
15												
								17.5	Gray SILT, some fine sand	2A		
								17.7	Bottom of Boring 17.7'			
									Note: 4.0' Landfill sediment observed/estimated			

GROUND SURFACE TO Top of Silt USED BW CASING: THEN Spoon to 17.7'

Sample Type	Proportions Used		140 lb. Wt x 30" fall on 2" O.D. Sampler					SUMMARY:
D=Drive C=Cored W=Washed	trace	0 to 10%	Cohesionless	Density	Cohesive	Consistency		Earth Boring 17.7'
UP=Fixed Piston UT=Shelby Tube	little	10 to 20%	0-10	Loose	0-4	Soft	30 + Hard	Rock Coring
TP=Test Pit A=Auger	some	20 to 35%	10-30	Med. Dense	4-8	M./Stiff		Samples 2
OE = Open End Rod	and	35 to 50%	30-50	Dense	8-15	Stiff		
* 300# hammer			50+	Very Dense	15-30	V-Stiff		HOLE NO. U-3

GUILD DRILLING CO., INC.
100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc.
PROJECT NAME Pond Sediment Investigation
REPORT SENT TO above

ADDRESS Foxboro, Mass.
LOCATION Johnston, R.I.
OUR JOB NO. 92-156

HOLE NO. U-4
PROJ. NO.
SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.	DATE	
At ____ after ____ Hours	Type	BW	S/S		Start	4/28/92
	Size I.D.	2-1/2"	1-3/8"		Complete	4/28/92
At ____ after ____ Hours	Hammer Wt.		140#	BIT	Boring Foreman	Paul Brescia
	Hammer Fall		30"		Inspector/Engr.	Dave Nacci

LOCATION OF BORING On Water, Simmons Upper Reservoir, 8' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./ Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-5.0	D	Pushed					Dark Gray SILT, Landfill Sediment	1	60	12
								3.0	Dark Brown sandy fibrous PEAT	1A		
5		5.0-7.0	D	7	7	7 8		5.0	Gray Brown silty fine to medium SAND, trace fine gravel	2	24	14
								7.0	Bottom of Boring 7'			
									Note: 3.0' Landfill sediment observed/estimated			

GROUND SURFACE TO Top of Mud USED BW CASING: THEN Spoon to 7'

Sample Type	Proportions Used		140 lb. Wt x 30" fall on 2" O.D. Sampler					SUMMARY:
D=Drive C=Cored W=Washed	trace	0 to 10%	Cohesionless	Density	Cohesive	Consistency		Earth Boring 7'
UP=Fixed Piston UT=Shelby Tube	little	10 to 20%	0-10	Loose	0-4	Soft	30 + Hard	Rock Coring
TP=Test Pit A=Auger	some	20 to 35%	10-30	Med. Dense	4-8	M./Stiff		Samples 2
OE = Open End Rod	and	35 to 50%	30-50	Dense	8-15	Stiff		HOLE NO. U-4
* 300# hammer			50+	Very Dense	15-30	V-Stiff		

GUILD DRILLING CO., INC.
100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc. | ADDRESS Foxboro, Mass. | HOLE NO. U-5
PROJECT NAME Pond Sediment Investigation | LOCATION Johnston, R.I. | PROJ. NO.
REPORT SENT TO above | OUR JOB NO. 92-156 | SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.		DATE
At ____ after ____ Hours	Type	BW	S/S		Start	4/28/92
	Size I.D.	2-1/2"	1-3/8"		Complete	4/28/92
At ____ after ____ Hours	Hammer Wt.		140#	BIT	Boring Foreman	Paul Brescia
	Hammer Fall		30"		Inspector/Engr.	Dave Nacci

LOCATION OF BORING On Water, Simmons Upper Reservoir, 5' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./ Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-2.5	D	Pushed					Dark Gray sandy SILT, Landfill Sediment	1	30	14
								2.0	Dark Brown fibrous PEAT	1A		
		2.5-4.0	D	4	4	6			Gray Brown varved silty SAND, trace clay	2	18	11
								2.5				
								4.0	Bottom of Boring 4'			
									Note: 2.0' Landfill sediment observed/estimated			

GROUND SURFACE TO Top of Mud USED BW CASING: THEN Spoon to 4'

Sample Type	Proportions Used		140 lb. Wt x 30" fall on 2" O.D. Sampler					SUMMARY:
D=Drive C=Cored W=Washed	trace	0 to 10%	Cohesionless	Density	Cohesive	Consistency		Earth Boring 4'
UP=Fixed Piston UT=Shelby Tube	little	10 to 20%	0-10	Loose	0-4	Soft	30 + Hard	Rock Coring
TP=Test Pit A=Auger	some	20 to 35%	10-30	Med. Dense	4-8	M./Stiff		Samples 2
OE = Open End Rod	and	35 to 50%	30-50	Dense	8-15	Stiff		
* 300# hammer			50+	Very Dense	15-30	V-Stiff		HOLE NO. U-5

GUILD DRILLING CO., INC.

100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc. ADDRESS Foxboro, Mass. HOLE NO. U-6

PROJECT NAME Pond Sediment Investigation LOCATION Johnston, R.I. PROJ. NO.

REPORT SENT TO above OUR JOB NO. 92-156 SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.		DATE
At ___ after ___ Hours	Type	BW	S/S		Start	4/28/92
	Size I.D.	2-1/2"	1-3/8"		Complete	4/28/92
At ___ after ___ Hours	Hammer Wt.		140#	BIT	Boring Foreman	Paul Brescia
	Hammer Fall		30"		Inspector/Engr.	Dave Nacci

LOCATION OF BORING On Water, Simmons Upper Reservoir, 5' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./ Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-2.0	D	Pushed					Gray SILT, trace of peat, Landfill Sediment	1	24	12
								1.0	Gray silty fine to medium SAND, some fine gravel	1A		
								2.0	Bottom of Boring 2'			
									Note: 1.0' Landfill sediment observed/estimated			

GROUND SURFACE TO Top of Silt USED BW CASING: THEN Spoon to 2'

Sample Type
D=Drive C=Cored W=Washed
UP=Fixed Piston UT=Shelby Tube
TP=Test Pit A=Auger
OE = Open End Rod
* 300# hammer

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%
and	35 to 50%

140 lb. Wt x 30" fall on 2" O.D. Sampler

Cohesionless	Density	Cohesive	Consistency	
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M./Stiff	
30-50	Dense	8-15	Stiff	
50+	Very Dense	15-30	V-Stiff	

SUMMARY:
Earth Boring 2'
Rock Coring
Samples 1

HOLE NO. U-6

GUILD DRILLING CO., INC.
100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc.	ADDRESS Foxboro, Mass.	HOLE NO. U-7
PROJECT NAME Pond Sediment Investigation	LOCATION Johnston, R.I.	PROJ. NO.
REPORT SENT TO above	OUR JOB NO. 92-156	SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.	DATE	
At ____ after ____ Hours	Type	BW	S/S		Start	4/28/92
	Size I.D.	2-1/2"	1-3/8"		Complete	4/28/92
At ____ after ____ Hours	Hammer Wt.		140#	BIT	Boring Foreman	Paul Brescia
	Hammer Fall		30"		Inspector/Engr.	Dave Nacci

LOCATION OF BORING On Water, Simmons Upper Reservoir, 7' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./ Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-5.8	D	Pushed					Light Brown fine SAND, Landfill Sediment	1	70	12
								0.5	Gray SILT, Landfill Sediment	1A		
								4.0	Dark Brown fibrous PEAT	1B		
5												
								5.8	Bottom of Boring 5.8'			
									Note: @ 5.8' - Gray silty fine SAND			
									Note: 4.0' Landfill sediment observed/estimated			

GROUND SURFACE TO Top of Silt USED BW CASING: THEN Spoon to 5.8'

Sample Type	Proportions Used		140 lb. Wt x 30" fall on 2" O.D. Sampler					SUMMARY:
D=Drive C=Cored W=Washed	trace	0 to 10%	Cohesionless	Density	Cohesive	Consistency		Earth Boring 5.8'
UP=Fixed Piston UT=Shelby Tube	little	10 to 20%	0-10	Loose	0-4	Soft	30 + Hard	Rock Coring
TP=Test Pit A=Auger	some	20 to 35%	10-30	Med. Dense	4-8	M./Stiff		Samples 1
OE = Open End Rod	and	35 to 50%	30-50	Dense	8-15	Stiff		HOLE NO. U-7
* 300# hammer			50+	Very Dense	15-30	V-Stiff		

GUILD DRILLING CO., INC.
100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc. | ADDRESS Foxboro, Mass. | HOLE NO. U-8
PROJECT NAME Pond Sediment Investigation | LOCATION Johnston, R.I. | PROJ. NO.
REPORT SENT TO above | OUR JOB NO. 92-156 | SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.	DATE	
At ____ after ____ Hours	Type	BW	S/S		Start	4/29/92
	Size I.D.	2-1/2"	1-3/8"		Complete	4/29/92
At ____ after ____ Hours	Hammer Wt.		140#	BIT	Boring Foreman	Paul Brescia
	Hammer Fall		30"		Inspector/Engr.	Dave Nacci

LOCATION OF BORING On Water, Simmons Upper Reservoir, 5.5' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./ Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-4.8	D	Pushed					Gray SILT, Landfill Sediment	1	58	20
								3.5	Dark Brown silty PEAT	1A		
									Brown fine to coarse SAND			
								4.0	Bottom of Boring 4.8'			
								4.8				
									Note: 3.5' Landfill sediment observed/estimated			

GROUND SURFACE TO Top of Silt USED BW CASING: THEN Spoon to 4.8'

Sample Type	Proportions Used		140 lb. Wt x 30" fall on 2" O.D. Sampler					SUMMARY:
D=Drive C=Cored W=Washed	trace	0 to 10%	Cohesionless	Density	Cohesive	Consistency		Earth Boring 4.8'
UP=Fixed Piston UT=Shelby Tube	little	10 to 20%	0-10	Loose	0-4	Soft	30 + Hard	Rock Coring
TP=Test Pit A=Auger	some	20 to 35%	10-30	Med. Dense	4-8	M./Stiff		Samples 1
OE = Open End Rod	and	35 to 50%	30-50	Dense	8-15	Stiff		
* 300# hammer			50+	Very Dense	15-30	V-Stiff		HOLE NO. U-8

GUILD DRILLING CO., INC.
100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO	Maguire Group, Inc.	ADDRESS	Foxboro, Mass.	HOLE NO.	U-9
PROJECT NAME	Pond Sediment Investigation	LOCATION	Johnston, R.I.	PROJ. NO.	
REPORT SENT TO	above	OUR JOB NO.	92-156	SURF. ELEV.	SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.		DATE
At ____ after ____ Hours	Type	BW	S/S		Start	4/29/92
	Size I.D.	2-1/2"	1-3/8"		Complete	4/29/92
At ____ after ____ Hours	Hammer Wt.		140#	BIT	Boring Foreman	Paul Brescia
	Hammer Fall		30"		Inspector/Engr.	Dave Nacci

LOCATION OF BORING On Water, Simmons Upper Reservoir, 4.5' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./ Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-2.2	D	Pushed					Gray SILT, Landfill Sediment	1	26	14
								2.0	Peaty SILT	1A		
								2.2	Bottom of Boring 2.2'			
									Note: @ 2.2' - Fine to medium SAND			
									Note: 2.0' Landfill sediment observed/estimated			

GROUND SURFACE TO Top of Silt USED BW CASING: THEN Spoon to 2.2'

Sample Type	Proportions Used		140 lb. Wt x 30" fall on 2" O.D. Sampler					SUMMARY:
D=Drive C=Cored W=Washed	trace	0 to 10%	Cohesionless	Density	Cohesive	Consistency		Earth Boring 2.2'
UP=Fixed Piston UT=Shelby Tube	little	10 to 20%	0-10	Loose	0-4	Soft	30 + Hard	Rock Coring
TP=Test Pit A=Auger	some	20 to 35%	10-30	Med. Dense	4-8	M./Stiff		Samples 1
OE = Open End Rod	and	35 to 50%	30-50	Dense	8-15	Stiff		
* 300# hammer			50+	Very Dense	15-30	V-Stiff		HOLE NO. U-9

GUILD DRILLING CO., INC.
100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc.	ADDRESS Foxboro, Mass.	HOLE NO. U-10
PROJECT NAME Pond Sediment Investigation	LOCATION Johnston, R.I.	PROJ. NO.
REPORT SENT TO above	OUR JOB NO. 92-156	SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.	DATE	
At ___ after ___ Hours	Type		S/S		Start	4/29/92
	Size I.D.		1-3/8"		Complete	4/29/92
At ___ after ___ Hours	Hammer Wt.		140#	BIT	Boring Foreman	Paul Brescia
	Hammer Fall		30"		Inspector/Engr.	Dave Nacci

LOCATION OF BORING On Water, Simmons Upper Reservoir, 1.7' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./ Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-4.7	D	Pushed					Gray SILT, Landfill Sediment	1	56	16
								3.0	Dark Brown fibrous PEAT	1A		
								4.0	Gray fine to medium SAND			
								4.7	Bottom of Boring 4.7'			
									Note: 3.0' Landfill sediment observed/estimated			

GROUND SURFACE TO Top of Silt USED Spoon CASING: THEN

Sample Type	Proportions Used		140 lb. Wt x 30" fall on 2" O.D. Sampler					SUMMARY:
D=Drive C=Cored W=Washed	trace	0 to 10%	Cohesionless	Density	Cohesive	Consistency		Earth Boring 4.7'
UP=Fixed Piston UT=Shelby Tube	little	10 to 20%	0-10	Loose	0-4	Soft	30 + Hard	Rock Coring
TP=Test Pit A=Auger	some	20 to 35%	10-30	Med. Dense	4-8	M./Stiff		Samples 1
OE = Open End Rod	and	35 to 50%	30-50	Dense	8-15	Stiff		
* 300# hammer			50 +	Very Dense	15-30	V-Stiff		HOLE NO. U-10

GUILD DRILLING CO., INC.
100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc.
PROJECT NAME Pond Sediment Investigation
REPORT SENT TO above

ADDRESS Foxboro, Mass.
LOCATION Johnston, R.I.
OUR JOB NO. 92-156

HOLE NO. L-1
PROJ. NO.
SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS

At ______ after ____ Hours

At ______ after ____ Hours

	CASING	SAMPLER	CORE BAR.
Type		S/S	
Size I.D.		1-3/8"	
Hammer Wt.		Pushed	BIT
Hammer Fall			

	DATE
Start	4/30/92
Complete	4/30/92
Boring Foreman	P. Brescia
Inspector/Engr.	D. Nacci

LOCATION OF BORING On Water, Simmons Lower Reservoir, 2' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./ Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-1.8	D	Pushed					Dark Brown silty Organic PEAT, some fine sand	1	22	6
								1.8	Bottom of Boring 1.8'			
									Note: No surficial landfill sediment observed			

GROUND SURFACE TO 1.8' USED Spoon CASING: THEN

Sample Type
D=Drive C=Cored W=Washed
UP=Fixed Piston UT=Shelby Tube
TP=Test Pit A=Auger
OE = Open End Rod
* 300# hammer

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%
and	35 to 50%

140 lb. Wt x 30" fall on 2" O.D. Sampler

Cohesionless	Density	Cohesive	Consistency	
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M./Stiff	
30-50	Dense	8-15	Stiff	
50+	Very Dense	15-30	V-Stiff	

SUMMARY:
Earth Boring 1.8'
Rock Coring ____
Samples 1

HOLE NO. L-1

GUILD DRILLING CO., INC.

100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc.	ADDRESS Foxboro, Mass.	HOLE NO. L-2
ROJECT NAME Pond Sediment Investigation	LOCATION Johnston, R.I.	PROJ. NO.
EPORT SENT TO above	OUR JOB NO. 92-156	SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.	DATE	
At ____ after ____ Hours	Type		S/S		Start	4/30/92
	Size I.D.		1-3/8"		Complete	4/30/92
At ____ after ____ Hours	Hammer Wt.		Pushed	BIT	Boring Foreman	P. Brescia
	Hammer Fall				Inspector/Engr.	D. Nacci

LOCATION OF BORING On Water, Simmons Lower Reservoir, 3.7' of Water

epth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./ Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-1.8	D	Pushed					Dark Brown silty Organic PEAT	1	22	6
								1.8	Bottom of Boring 1.8'			
									Note: @ 1.8' - Gray medium to fine SAND			
									Note: No surficial landfill sediment observed			

GROUND SURFACE TO 1.8' USED Spoon CASING: THEN

Sample Type	Proportions Used		140 lb. Wt x 30" fall on 2" O.D. Sampler					SUMMARY:
D=Drive C=Cored W=Washed	trace	0 to 10%	Cohesionless	Density	Cohesive	Consistency		Earth Boring 1.8'
UP=Fixed Piston UT=Shelby Tube	little	10 to 20%	0-10	Loose	0-4	Soft	30 + Hard	Rock Coring
TP=Test Pit A=Auger	some	20 to 35%	10-30	Med. Dense	4-8	M./Stiff		Samples 1
OE = Open End Rod	and	35 to 50%	30-50	Dense	8-15	Stiff		
* 300# hammer			50+	Very Dense	15-30	V-Stiff		HOLE NO. L-2

GUILD DRILLING CO., INC.

100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc. ADDRESS Foxboro, Mass. HOLE NO. L-3

PROJECT NAME Pond Sediment Investigation LOCATION Johnston, R.I. PROJ. NO.

REPORT SENT TO above OUR JOB NO. 92-156 SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.	DATE	
At ____ after ____ Hours	Type		S/S		Start	4/30/92
	Size I.D.		1-3/8"		Complete	4/30/92
At ____ after ____ Hours	Hammer Wt.		Pushed	BIT	Boring Foreman	P. Brescia
	Hammer Fall				Inspector/Engr.	D. Nacci

LOCATION OF BORING On Water, Simmons Lower Reservoir, 2.5' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-1.7	D	Pushed					Dark Brown sandy Organic PEAT	1	21	6
								1.7	Bottom of Boring 1.7'			
									Note: @ 1.7' - Gray medium to fine SAND			
									Note: No surficial landfill sediment observed			

GROUND SURFACE TO 1.7' USED Spoon CASING: THEN

Sample Type	Proportions Used		140 lb. Wt x 30" fall on 2" O.D. Sampler					SUMMARY:
D=Drive C=Cored W=Washed			Cohesionless	Density	Cohesive	Consistency		Earth Boring 1.7'
UP=Fixed Piston UT=Shelby Tube	trace	0 to 10%	0-10	Loose	0-4	Soft	30 + Hard	Rock Coring
TP=Test Pit A=Auger	little	10 to 20%	10-30	Med. Dense	4-8	M./Stiff		Samples 1
OE = Open End Rod	some	20 to 35%	30-50	Dense	8-15	Stiff		
* 300# hammer	and	35 to 50%	50+	Very Dense	15-30	V-Stiff		HOLE NO. L-3

GUILD DRILLING CO., INC.

100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc. — ADDRESS Foxboro, Mass. — HOLE NO. L-4

PROJECT NAME Pond Sediment Investigation — LOCATION Johnston, R.I. — PROJ. NO.

REPORT SENT TO above — OUR JOB NO. 92-156 — SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.	DATE	
At ____ after ____ Hours	Type		S/S		Start	4/30/92
At ____ after ____ Hours	Size I.D.		1-3/8"		Complete	4/30/92
	Hammer Wt.		Pushed	BIT	Boring Foreman	P. Brescia
	Hammer Fall				Inspector/Engr.	D. Nacci

LOCATION OF BORING On Water, Simmons Lower Reservoir, 1.5' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./ Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-1.3	D	Pushed					Dark Brown silty Organic PEAT	1	16	4
								1.3	Bottom of Boring 1.3'			
									Note: @ 1.3' - Brown fine to medium SAND			
									Note: No surficial landfill sediment observed			

GROUND SURFACE TO 1.3' USED Spoon CASING: THEN

Sample Type	Proportions Used		140 lb. Wt x 30" fall on 2" O.D. Sampler					SUMMARY:
D=Drive C=Cored W=Washed	trace	0 to 10%	Cohesionless	Density	Cohesive	Consistency		Earth Boring 1.3'
UP=Fixed Piston UT=Shelby Tube	little	10 to 20%	0-10	Loose	0-4	Soft	30 + Hard	Rock Coring
TP=Test Pit A=Auger	some	20 to 35%	10-30	Med. Dense	4-8	M./Stiff		Samples 1
OE = Open End Rod	and	35 to 50%	30-50	Dense	8-15	Stiff		
* 300# hammer			50+	Very Dense	15-30	V-Stiff		HOLE NO. L-4

GUILD DRILLING CO., INC.

100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc.
ADDRESS Foxboro, Mass.
HOLE NO. L-5

PROJECT NAME Pond Sediment Investigation
LOCATION Johnston, R.I.
PROJ. NO.

REPORT SENT TO above
OUR JOB NO. 92-156
SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS

At ________ after ____ Hours

At ________ after ____ Hours

	CASING	SAMPLER	CORE BAR.
Type		S/S	
Size I.D.		1-3/8"	
Hammer Wt.		Pushed	BIT
Hammer Fall			

DATE

Start 4/30/92

Complete 4/30/92

Boring Foreman P. Brescia

Inspector/Engr. D. Nacci

LOCATION OF BORING On Water, Simmons Lower Reservoir, 2.8' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./ Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-2.8	D	Pushed					Dark Brown silty Organic PEAT	1	34	16
								2.8	Bottom of Boring 2.8'			
									Note: @ 2.8' - Gray medium to fine SAND			
									Note: No surficial landfill sediment observed			

GROUND SURFACE TO 2.8' USED Spoon CASING: THEN

Sample Type
D=Drive C=Cored W=Washed
UP=Fixed Piston UT=Shelby Tube
TP=Test Pit A=Auger
OE = Open End Rod
* 300# hammer

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%
and	35 to 50%

140 lb. Wt x 30" fall on 2" O.D. Sampler

Cohesionless	Density	Cohesive	Consistency	
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M./Stiff	
30-50	Dense	8-15	Stiff	
50+	Very Dense	15-30	V-Stiff	

SUMMARY:
Earth Boring 2.8'
Rock Coring ____
Samples 1

HOLE NO. L-5

GUILD DRILLING CO., INC.

100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc.	ADDRESS Foxboro, Mass.	HOLE NO. L-6
PROJECT NAME Pond Sediment Investigation	LOCATION Johnston, R.I.	PROJ. NO.
REPORT SENT TO above	OUR JOB NO. 92-156	SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS

At ________ after ____ Hours

At ________ after ____ Hours

	CASING	SAMPLER	CORE BAR.
Type		S/S	
Size I.D.		1-3/8"	
Hammer Wt.		Pushed	BIT
Hammer Fall			

DATE	
Start	4/30/92
Complete	4/30/92
Boring Foreman	P. Brescia
Inspector/Engr.	D. Nacci

LOCATION OF BORING On Water, Simmons Lower Reservoir, 2' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./ Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-1.8	D	Pushed					Dark Brown silty Organic PEAT	1	22	10
								1.8	Bottom of Boring 1.8'			
									Note: @ 1.8' - Gray medium to fine SAND			
									Note: No surficial landfill sediment observed			

GROUND SURFACE TO 1.8' USED Spoon CASING: THEN

Sample Type	Proportions Used		140 lb. Wt x 30" fall on 2" O.D. Sampler				
D=Drive C=Cored W=Washed	trace	0 to 10%	Cohesionless	Density	Cohesive	Consistency	
UP=Fixed Piston UT=Shelby Tube	little	10 to 20%	0-10	Loose	0-4	Soft	30 + Hard
TP=Test Pit A=Auger	some	20 to 35%	10-30	Med. Dense	4-8	M./Stiff	
OE = Open End Rod	and	35 to 50%	30-50	Dense	8-15	Stiff	
* 300# hammer			50+	Very Dense	15-30	V-Stiff	

SUMMARY:

Earth Boring 1.8'

Rock Coring ____

Samples 1

HOLE NO. L-6

GUILD DRILLING CO., INC.
100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc.	ADDRESS Foxboro, Mass.	HOLE NO. L-7
PROJECT NAME Pond Sediment Investigation	LOCATION Johnston, R.I.	PROJ. NO.
REPORT SENT TO above	OUR JOB NO. 92-156	SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.	DATE	
At ____ after ____ Hours	Type		S/S		Start	4/30/92
	Size I.D.		1-3/8"		Complete	4/30/92
At ____ after ____ Hours	Hammer Wt.		Pushed	BIT	Boring Foreman	P. Brescia
	Hammer Fall				Inspector/Engr.	D. Nacci

LOCATION OF BORING On Water, Simmons Lower Reservoir, 1.3' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./ Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-3.8	D	Pushed					Dark Brown fibrous PEAT	1	46	18
								3.8	Bottom of Boring 3.8'			
									Note: @ 3.8' - Brown fine SAND			
									Note: No surficial landfill sediment observed			

GROUND SURFACE TO 3.8' USED Spoon CASING: THEN

Sample Type
D=Drive C=Cored W=Washed
UP=Fixed Piston UT=Shelby Tube
TP=Test Pit A=Auger
OE = Open End Rod
* 300# hammer

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%
and	35 to 50%

140 lb. Wt x 30" fall on 2" O.D. Sampler

Cohesionless	Density	Cohesive	Consistency	
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M./Stiff	
30-50	Dense	8-15	Stiff	
50+	Very Dense	15-30	V-Stiff	

SUMMARY:
Earth Boring 3.8'
Rock Coring
Samples 1

HOLE NO. L-7

GUILD DRILLING CO., INC.
100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

O Maguire Group, Inc.	ADDRESS Foxboro, Mass.	HOLE NO. L-8
OJECT NAME Pond Sediment Investigation	LOCATION Johnston, R.I.	PROJ. NO.
PORT SENT TO above	OUR JOB NO. 92-156	SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.		DATE
t ___ after ___ Hours	Type		Hand		Start	4/30/92
	Size I.D.		Sample		Complete	4/30/92
At ___ after ___ Hours	Hammer Wt.			BIT	Boring Foreman	P. Brescia
	Hammer Fall				Inspector/Engr.	D. Nacci

LOCATION OF BORING On Water, Simmons Lower Reservoir, 1' of Water

pth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./ Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-0.3	D	Hand	Sample				Brown medium to coarse SAND	1	3	3
								0.3	Bottom of Boring 0.3'			
									Note: Took sample by hand from bottom			
									Note: No surficial landfill sediment observed			

GROUND SURFACE TO ___ USED ___ CASING: THEN ___

Sample Type
D=Drive C=Cored W=Washed
UP=Fixed Piston UT=Shelby Tube
TP=Test Pit A=Auger
OE = Open End Rod
* 300# hammer

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%
and	35 to 50%

140 lb. Wt x 30" fall on 2" O.D. Sampler

Cohesionless	Density	Cohesive	Consistency	
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M./Stiff	
30-50	Dense	8-15	Stiff	
50+	Very Dense	15-30	V-Stiff	

SUMMARY:
Earth Boring 0.3'
Rock Coring ___
Samples 1

HOLE NO. L-8

GUILD DRILLING CO., INC.

100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc. ADDRESS Foxboro, Mass. HOLE NO. L-9

PROJECT NAME Pond Sediment Investigation LOCATION Johnston, R.I. PROJ. NO.

REPORT SENT TO above OUR JOB NO. 92-156 SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.	DATE	
At ____ after ____ Hours	Type		S/S		Start	4/30/92
	Size I.D.		I-3/8"		Complete	4/30/92
At ____ after ____ Hours	Hammer Wt.		Pushed	BIT	Boring Foreman	P. Brescia
	Hammer Fall				Inspector/Engr.	D. Nacci

LOCATION OF BORING On Water, Simmons Lower Reservoir, 1' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-2.8	D	Pushed					Dark Brown fibrous PEAT	1	34	12
								2.8	Bottom of Boring 2.8'			
									Note: @ 2.8' - Brown fine to medium SAND			
									Note: No surficial landfill sediment observed			

GROUND SURFACE TO 2.8' USED Spoon CASING: THEN

Sample Type
D=Drive C=Cored W=Washed
UP=Fixed Piston UT=Shelby Tube
TP=Test Pit A=Auger
OE = Open End Rod
* 300# hammer

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%
and	35 to 50%

140 lb. Wt x 30" fall on 2" O.D. Sampler

Cohesionless	Density	Cohesive	Consistency	
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M./Stiff	
30-50	Dense	8-15	Stiff	
50+	Very Dense	15-30	V-Stiff	

SUMMARY:
Earth Boring 2.8'
Rock Coring ____
Samples 1

HOLE NO. L-9

GUILD DRILLING CO., INC.

100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc. | ADDRESS Foxboro, Mass. | HOLE NO. L-10

PROJECT NAME Pond Sediment Investigation | LOCATION Johnston, R.I. | PROJ. NO.

REPORT SENT TO above | OUR JOB NO. 92-156 | SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.		DATE
At ______ after ____ Hours	Type		S/S		Start	4/30/92
	Size I.D.		1-3/8"		Complete	4/30/92
At ______ after ____ Hours	Hammer Wt.		Pushed	BIT	Boring Foreman	P. Brescia
	Hammer Fall				Inspector/Engr.	D. Nacci

LOCATION OF BORING On Water, Simmons Lower Reservoir, 1' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-3.3	D	Pushed					Dark Brown silty Organic PEAT	1	40	8
								3.3	Bottom of Boring 3.3'			
									Note: @ 3.3' - Brown fine to medium SAND			
									Note: No surficial landfill sediment observed			

GROUND SURFACE TO 3.3' USED Spoon CASING: THEN

Sample Type
D=Drive C=Cored W=Washed
UP=Fixed Piston UT=Shelby Tube
TP=Test Pit A=Auger
OE = Open End Rod
* 300# hammer

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%
and	35 to 50%

140 lb. Wt x 30" fall on 2" O.D. Sampler

Cohesionless	Density	Cohesive	Consistency	
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M./Stiff	
30-50	Dense	8-15	Stiff	
50+	Very Dense	15-30	V-Stiff	

SUMMARY:
Earth Boring 3.3'
Rock Coring
Samples 1

HOLE NO. L-10

GUILD DRILLING CO., INC.

100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

O Maguire Group, Inc. | ADDRESS Foxboro, Mass. | HOLE NO. L-11

OJECT NAME Pond Sediment Investigation | LOCATION Johnston, R.I. | PROJ. NO.

PORT SENT TO above | OUR JOB NO. 92-156 | SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.	DATE	
t ______ after ____ Hours	Type		S/S		Start	4/30/92
	Size I.D.		1-3/8"		Complete	4/30/92
At ______ after ____ Hours	Hammer Wt.		Pushed	BIT	Boring Foreman	P. Brescia
	Hammer Fall				Inspector/Engr.	D. Nacci

LOCATION OF BORING On Water, Simmons Lower Reservoir, 1.5' of Water

pth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./ Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-3.3	D	Pushed					Dark Brown sandy PEAT	1	40	16
								3.3	Bottom of Boring 3.3'			
									Note: @ 3.3' - Brown fine to medium SAND			
									Note: No surficial landfill sediment observed			

GROUND SURFACE TO 3.3' USED Spoon CASING: THEN

Sample Type	Proportions Used		140 lb. Wt x 30" fall on 2" O.D. Sampler					SUMMARY:
D=Drive C=Cored W=Washed	trace	0 to 10%	Cohesionless	Density	Cohesive	Consistency		Earth Boring 3.3'
UP=Fixed Piston UT=Shelby Tube	little	10 to 20%	0-10	Loose	0-4	Soft	30 + Hard	Rock Coring
TP=Test Pit A=Auger	some	20 to 35%	10-30	Med. Dense	4-8	M./Stiff		Samples 1
OE = Open End Rod	and	35 to 50%	30-50	Dense	8-15	Stiff		
* 300# hammer			50+	Very Dense	15-30	V-Stiff		HOLE NO. L-11

GUILD DRILLING CO., INC.

100 WATER STREET • EAST PROVIDENCE, R.I.

SHEET 1 OF 1

TO Maguire Group, Inc. — ADDRESS Foxboro, Mass. — HOLE NO. L-12

PROJECT NAME Pond Sediment Investigation — LOCATION Johnston, R.I. — PROJ. NO.

REPORT SENT TO above — OUR JOB NO. 92-156 — SURF. ELEV. SED. SURF.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.	DATE	
At ______ after ____ Hours	Type		S/S		Start	4/30/92
	Size I.D.		1-3/8"		Complete	4/30/92
At ______ after ____ Hours	Hammer Wt.		Pushed	BIT	Boring Foreman	P. Brescia
	Hammer Fall				Inspector/Engr.	D. Nacci

LOCATION OF BORING On Water, Simmons Lower Reservoir, 0.8' of Water

Depth	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev./Depth	SOIL OR ROCK IDENTIFICATION Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams, etc.	SAMPLE No.	Pen"	Rec."
		0.0-3.8	D	Pushed					Dark Brown silty Organic PEAT	1	46	12
								3.8	Bottom of Boring 3.8'			
									Note: @ 3.8' - Brown fine to medium SAND			
									Note: No surficial landfill sediment observed			

GROUND SURFACE TO 3.8' USED Spoon CASING: THEN

Sample Type	Proportions Used		140 lb. Wt x 30" fall on 2" O.D. Sampler					SUMMARY:
D=Drive C=Cored W=Washed	trace	0 to 10%	Cohesionless	Density	Cohesive	Consistency		Earth Boring 3.8'
UP=Fixed Piston UT=Shelby Tube	little	10 to 20%	0-10	Loose	0-4	Soft	30 + Hard	Rock Coring
TP=Test Pit A=Auger	some	20 to 35%	10-30	Med. Dense	4-8	M./Stiff		Samples 1
OE = Open End Rod	and	35 to 50%	30-50	Dense	8-15	Stiff		
* 300# hammer			50+	Very Dense	15-30	V-Stiff		

HOLE NO. L-12

APPENDIX B

COST ESTIMATE

Maguire Group Inc.
Architects/Engineers/Planners
225 Foxborough Boulevard
Foxborough, Massachusetts 02035

COST ESTIMATE

BUDGET ______ JOB NO. 13488
PRELIMINARY ✓ DATE 6/15/92
FINAL ______ BY JMM
CKD ______

PROJECT RISWMC DREDGING + DEWATERING
SUBJECT UPPER SIMMONS RESEVOIR

ITEM DESCRIPTION	QUANTITIES	UNIT	EQUIPMENT UNIT COST	EQUIPMENT	MATERIAL UNIT COST	MATERIAL	LABOR UNIT COST	LABOR	TOTAL COST UNIT COST	TOTAL COST
MOBILIZATION	1	LS							40 k	40,000
restoration	1	LS							10 k	10,000
							subtot	50,000		
DISCHARGE PIPING	8000	LF							2	16,000
							subtot	16,000		
DREDGING	250,000	CY							6	1,500,000
							subtot	1,500,000		
DEWATERING AREA										
excavation	8000	CY							4.5	36,000
embankment	20,000	CY							4.5	90,000
Grading + Compaction	28,000	CY							1.0	28,000
outlet structures	1	LS							10 k	10,000
Rip Rap	50	Tons							150	7,500
filter fabric	1700	SY							1.0	1,700
Silt Barriers	1000	LF							10	10,000
hydro seeding	4	ac							1500	6,000
Flocculation	1	LS							10 k	10,000
biweekly cleaning	20	EA							25 k	500,000
							subtot	699,200		
SILTATION FENCES										
Remove existing fences	2	EA							500	1000
install, anchor + maintain new	1200	LF							15	18,000
							subtot	19,000		
							TOTAL	2,284,200	TOTAL	2,284,200
10% Profit								228,420		
10% overhead								228,420		
5% contingency								114,210		
TOTAL								2,855,250		2,855,250

APPENDIX C

CHEMICAL ANALYSIS

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

Client: The Environmental Scientific Corp.

Analysis Requested: Listed below

Sample Number: 890498.2

Date Received: 05/26/89

Date Reported: 06/12/89

Client Ident: Sediment #1
Sample Location:
Sample Description: Sediment
Sample Container: Glass jars & vials
Field Prep: pH>12 for cyanide w/NaOH
pH<2 for metals w/HNO_3
pH<2 for TPH w/ HCl
pH<2 for TKN & phosphorous w/H_2SO_4

# of Containers: 4

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Total Metals	——	——	——	——	1	3050	06/07/89	——
Arsenic	0.7	mg/Kg	0.2	HGA	1	7060	——	06/08/89
Barium	42	mg/Kg	5	AAS	1	7080	——	06/08/89
Cadmium	0.7	mg/Kg	0.2	AAS	1	7130	——	06/08/89
Chromium	ND	mg/Kg	2	AAS	1	7190	——	06/08/89
Copper	7	mg/Kg	1	AAS	1	7210	——	06/08/89
Lead	22	mg/Kg	2	AAS	1	7420	——	06/08/89
Mercury	ND	mg/Kg	0.02	CV	1	7471	——	06/08/89
Selenium	ND	mg/Kg	0.2	HGA	1	7740	——	06/08/89
Silver	ND	mg/Kg	0.5	AAS	1	7760	——	06/08/89
Vanadium	16.9	mg/Kg	0.2	ICP	1	6010	——	06/08/89
Zinc	164	mg/Kg	0.2	AAS	1	7950	——	06/08/89
% Solids	66	%	---	Grav	2	209A	——	06/08/89
EP Toxicity Extraction	——	——	——	---	1	1310	06/07/89	——
Arsenic	ND	mg/L	0.005	HGA	1	7060	——	06/08/89
Cadmium	0.010	mg/L	0.005	AAS	1	7130	——	06/08/89
Chromium	ND	mg/L	0.05	AAS	1	7190	——	06/08/89
Copper	0.02	mg/L	0.02	AAS	1	7210	——	06/08/89
Lead	ND	mg/L	0.05	AAS	1	7420	——	06/08/89
Mercury	ND	mg/L	0.0005	CV	1	7470	——	06/08/89
Nickel	0.10	mg/L	0.04	AAS	1	7520	——	06/08/89
Vanadium	0.008	mg/L	0.005	ICP	1	6010	——	06/08/89
Zinc	4.13	mg/L	0.005	AAS	1	7950	——	06/08/89

* MDL—Method Detection Limits (same units as the Results)
** REF—Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

Client: The Environmental Scientific Corp.

Analysis Requested: Listed below

Sample Number: 890498.2

Date Received: 05/26/89

Date Reported: 06/12/89

Client Ident: Sediment #1
Sample Location:
Sample Description: Sediment
Sample Container: Glass jars & vials
Field Prep: pH>12 for cyanide w/NaOH
pH<2 for metals w/HNO_3
pH<2 for TPH w/ HCl
pH<2 for TKN & phosphorous w/H_2SO_4

# of Containers: 4

CONTINUED

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
HSL Acid/Base/Neutral Extractables								
Phenol	2,420	ug/Kg	1*	GC/MS	1	8270	06/01/89	06/02/89
PCB'S	ND	mg/Kg	0.250	GC	1	8080	06/01/89	06/02/89
Pesticides	ND	mg/Kg	0.05	GC	1	8080	06/01/89	06/02/89
HSL Volatile Organics								
Volatile Halocarbons	ND	ug/Kg	1*	GC/MS	1	8240	——	06/06/89
Volatile Aromatics	ND	ug/Kg	1*	GC/MS	1	8240	——	06/06/89

NOTE: All compounds were below the detection limits except those listed above.

1* A list of acid/base neutral extractables and volatile organics analyzed for and their detection limits accompanies this report.

A list of PCB'S and pesticides analyzed for accompanies this report.

* MDL—Method Detection Limits (same units as the Results)
** REF—Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

Client: The Environmental Scientific Corp.

Sample Number: 890498.2

Analysis Requested: Listed below

Date Received: 05/26/89

Date Reported: 06/12/89

Client Ident: Sediment #1
Sample Location:
Sample Description: Sediment
Sample Container: Glass jars & vials

# of Containers: 4

Field Prep: pH>12 for cyanide w/NaOH
pH<2 for metals w/HNO_3
pH<2 for TPH w/ HCl
pH<2 for TKN & phosphorous w/H_2SO_4

CONTINUED

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Total Cyanide	ND	mg/Kg	0.4	Spect	2	412B&D	——	06/06/89
Total Petroleum Hydrocarbons	1,230	mg/Kg	40	IR	2	503B/D/E	——	06/06/89
Nitrogen								
Nitrate as N	ND	mg/Kg	0.5	Spect	5	3-183	05/26/89	05/26/89
TKN as N	469	mg/Kg	10.	Spect	5	3-201D	——	06/09/89
Total Phosphate	---	---	---	---	5	3-227	06/09/89	——
Phosphorous	1.83	mg/Kg	0.05	Spect	2	424B/E	——	06/09/89

* MDL—Method Detection Limits (same units as the Results)
** REF—Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

Client: The Environmental Scientific Corp.

Analysis Requested: Listed below

Sample Number: 890498.3

Date Received: 05/26/89

Date Reported: 06/12/89

Client Ident: Sediment #2
Sample Location:
Sample Description: Sediment
Sample Container: Glass jars & vials
Field Prep: pH>12 for cyanide w/NaOH
pH<2 for metals w/HNO_3
pH<2 for TPH w/ HCl
pH<2 for TKN & phosphorous w/H_2SO_4

\# of Containers: 4

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Total Metals	—	—	—	—	1	3050	06/07/89	—
Arsenic	0.5	mg/Kg	0.2	HGA	1	7060	—	06/08/89
Barium	32	mg/Kg	5	AAS	1	7080	—	06/08/89
Cadmium	ND	mg/Kg	0.2	AAS	1	7130	—	06/08/89
Chromium	ND	mg/Kg	2	AAS	1	7190	—	06/08/89
Copper	6	mg/Kg	1	AAS	1	7210	—	06/08/89
Lead	8	mg/Kg	2	AAS	1	7420	—	06/08/89
Mercury	ND	mg/Kg	0.02	CV	1	7471	—	06/08/89
Selenium	ND	mg/Kg	0.2	HGA	1	7740	—	06/08/89
Silver	ND	mg/Kg	0.5	AAS	1	7760	—	06/08/89
Vanadium	38.9	mg/Kg	0.2	ICP	1	6010	—	06/08/89
Zinc	74.7	mg/Kg	0.2	AAS	1	7950	—	06/08/89
% Solids	77	%	---	Grav	2	209A	—	06/08/89
EP Toxicity Extraction	—	—	—	—	1	1310	06/07/89	—
Arsenic	ND	mg/L	0.005	HGA	1	7060	—	06/08/89
Cadmium	ND	mg/L	0.005	AAS	1	7130	—	06/08/89
Chromium	ND	mg/L	0.05	AAS	1	7190	—	06/08/89
Copper	0.05	mg/L	0.02	AAS	1	7210	—	06/08/89
Lead	ND	mg/L	0.05	AAS	1	7420	—	06/08/89
Mercury	ND	mg/L	0.0005	CV	1	7470	—	06/08/89
Nickel	0.20	mg/L	0.04	AAS	1	7520	—	06/08/89
Vanadium	0.007	mg/L	0.005	ICP	1	6010	—	06/08/89
Zinc	1.12	mg/L	0.005	AAS	1	7950	—	06/08/89

* MDL—Method Detection Limits (same units as the Results)
** REF—Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

Client: The Environmental Scientific Corp.

Sample Number: 890498.3

Analysis Requested: Listed below

Date Received: 05/26/89

Date Reported: 06/12/89

Client Ident: Sediment #2
Sample Location:
Sample Description: Sediment
Sample Container: Glass jars & vials
Field Prep: pH>12 for cyanide w/NaOH
pH<2 for metals w/HNO_3
pH<2 for TPH w/ HCl
pH<2 for TKN & phosphorous w/H_2SO_4

\# of Containers: 4

CONTINUED

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
HSL Acid/Base/Neutral Extractables								
Phenol	770	ug/Kg	1*	GC/MS	1	8270	06/01/89	06/02/89
PCB'S	ND	mg/Kg	0.250	GC	1	8080	06/01/89	06/02/89
Pesticides	ND	mg/Kg	0.05	GC	1	8080	06/01/89	06/02/89
HSL Volatile Organics								
Volatile Halocarbons	ND	ug/Kg	1*	GC/MS	1	8240	----	06/06/89
Volatile Aromatics	ND	ug/Kg	1*	GC/MS	1	8240	----	06/06/89

NOTE: All compounds were below the detection limits except those listed above.

1* A list of acid/base neutral extractables and volatile organics analyzed for and their detection limits accompanies this report.

A list of PCB'S and pesticides analyzed for accompanies this report.

* MDL—Method Detection Limits (same units as the Results)
** REF—Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

Client: The Environmental Scientific Corp.

Analysis Requested: Listed below

Sample Number: 890498.3

Date Received: 05/26/89

Date Reported: 06/12/89

Client Ident: Sediment #2
Sample Location:
Sample Description: Sediment
Sample Container: Glass jars & vials
Field Prep: pH>12 for cyanide w/NaOH
pH<2 for metals w/HNO_3
pH<2 for TPH w/ HCl
pH<2 for TKN & phosphorous w/H_2SO_4

# of Containers: 4

CONTINUED

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Total Cyanide	ND	mg/Kg	0.4	Spect	2	412B&D	——	06/06/89
Total Petroleum Hydrocarbons	389	mg/Kg	40	IR	2	503B/D/E	——	06/06/89
Nitrogen								
Nitrate as N	ND	mg/Kg	0.5	Spect	5	3-183	05/26/89	05/26/89
TKN as N	285	mg/Kg	10.	Spect	5	3-201D	——	06/09/89
Total Phosphate	---	——	——	---	5	3-227	06/09/89	——
Phosphorous	3.10	mg/Kg	0.05	Spect	2	424B/E	——	06/09/89

* MDL—Method Detection Limits (same units as the Results)
** REF—Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

Client: The Environmental Scientific Corp.

Sample Number: 890498.4

Analysis Requested: Listed below

Date Received: 05/26/89

Date Reported: 06/12/89

Client Ident: Sediment #3
Sample Location:
Sample Description: Sediment
Sample Container: Glass jars & vials
# of Containers: 4
Field Prep: pH>12 for cyanide w/NaOH
pH<2 for metals w/HNO_3
pH<2 for TPH w/ HCl
pH<2 for TKN & phosphorous w/H_2SO_4

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Total Metals	---	---	---	---	1	3050	06/07/89	---
Arsenic	0.7	mg/Kg	0.2	HGA	1	7060	---	06/08/89
Barium	69	mg/Kg	5	AAS	1	7080	---	06/08/89
Cadmium	0.4	mg/Kg	0.2	AAS	1	7130	---	06/08/89
Chromium	6	mg/Kg	2	AAS	1	7190	---	06/08/89
Copper	14	mg/Kg	1	AAS	1	7210	---	06/08/89
Lead	27	mg/Kg	2	AAS	1	7420	---	06/08/89
Mercury	ND	mg/Kg	0.02	CV	1	7471	---	06/08/89
Selenium	ND	mg/Kg	0.2	HGA	1	7740	---	06/08/89
Silver	ND	mg/Kg	0.5	AAS	1	7760	---	06/08/89
Vanadium	29.3	mg/Kg	0.2	ICP	1	6010	---	06/08/89
Zinc	110	mg/Kg	0.2	AAS	1	7950	---	06/08/89
% Solids	57	%	---	Grav	2	209A	---	06/08/89
EP Toxicity Extraction	---	---	---	---	1	1310	06/07/89	---
Arsenic	ND	mg/L	0.005	HGA	1	7060	---	06/08/89
Cadmium	ND	mg/L	0.005	AAS	1	7130	---	06/08/89
Chromium	ND	mg/L	0.05	AAS	1	7190	---	06/08/89
Copper	ND	mg/L	0.02	AAS	1	7210	---	06/08/89
Lead	ND	mg/L	0.05	AAS	1	7420	---	06/08/89
Mercury	ND	mg/L	0.0005	CV	1	7470	---	06/08/89
Nickel	ND	mg/L	0.04	AAS	1	7520	---	06/08/89
Vanadium	ND	mg/L	0.005	ICP	1	6010	---	06/08/89
Zinc	0.363	mg/L	0.005	AAS	1	7950	---	06/08/89

* MDL—Method Detection Limits (same units as the Results)
** REF—Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

Client: The Environmental Scientific Corp.

Analysis Requested: Listed below

Sample Number: 890498.4

Date Received: 05/26/89

Date Reported: 06/12/89

Client Ident: Sediment #3
Sample Location:
Sample Description: Sediment
Sample Container: Glass jars & vials
Field Prep: pH>12 for cyanide w/NaOH
pH<2 for metals w/HNO_3
pH<2 for TPH w/ HCl
pH<2 for TKN & phosphorous w/H_2SO_4

# of Containers: 4

CONTINUED

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
HSL Acid/Base/Neutral Extractables								
Phenol	2,800	ug/Kg	1*	GC/MS	1	8270	06/01/89	06/02/89
PCB'S	ND	mg/Kg	0.250	GC	1	8080	06/01/89	06/02/89
Pesticides	ND	mg/Kg	0.05	GC	1	8080	06/01/89	06/02/89
HSL Volatile Organics								
Volatile Halocarbons	ND	ug/Kg	1*	GC/MS	1	8240	——	06/06/89
Volatile Aromatics	ND	ug/Kg	1*	GC/MS	1	8240	——	06/06/89

NOTE: All compounds were below the detection limits except those listed above.

1* A list of acid/base neutral extractables and volatile organics analyzed for and their detection limits accompanies this report.

A list of PCB'S and pesticides analyzed for accompanies this report.

* MDL—Method Detection Limits (same units as the Results)
** REF—Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

Client: The Environmental Scientific Corp.

Analysis Requested: Listed below

Sample Number: 890498.4

Date Received: 05/26/89

Date Reported: 06/12/89

Client Ident: Sediment #3
Sample Location:
Sample Description: Sediment
Sample Container: Glass jars & vials
Field Prep: pH>12 for cyanide w/NaOH
pH<2 for metals w/HNO_3
pH<2 for TPH w/ HCl
pH<2 for TKN & phosphorous w/H_2SO_4

# of Containers: 4

CONTINUED

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
Total Cyanide	ND	mg/Kg	0.4	Spect	2	412B&D	----	06/06/89
Total Petroleum Hydrocarbons	916	mg/Kg	40	IR	2	503B/D/E	----	06/06/89
Nitrogen								
Nitrate as N	ND	mg/Kg	0.5	Spect	5	3-183	05/26/89	05/26/89
TKN as N	595	mg/Kg	10.	Spect	5	3-201D	----	06/09/89
Total Phosphate	---	---	---	---	5	3-227	06/09/89	----
Phosphorous	3.95	mg/Kg	0.05	Spect	2	424B/E	----	06/09/89

* MDL--Method Detection Limits (same units as the Results)
** REF--Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

Client: The Environmental Scientific Corp.

Analysis Requested: HSL Volatile Organics

Sample Number: 890498.5

Date Received: 05/26/89

Date Reported: 06/12/89

Client Ident: TRIP BLANK
Sample Location:
Sample Description: Water
Sample Container: Glass vials
Field Prep: None

# of Containers: 4

PARAMETER	RESULT	UNITS	MDL*	INST	REF**	METHOD	EXTRACT	ANALYSIS
HSL Volatile Organics								
Volatile Halocarbons	ND	ug/L	1*	GC/MS	1	8240	----	06/06/89
Volatile Aromatics	ND	ug/L	1*	GC/MS	1	8240	----	06/06/89

NOTE: All compounds were below the detection limits except those listed above.

1* A list of volatile organics analyzed for and their detection limits accompanies this report.

A list of PCB'S and pesticides analyzed for accompanies this report.

* MDL—Method Detection Limits (same units as the Results)
** REF—Reference as cited on the cover (first) page of this report.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

Client: The Environmental Scientific Corp.

Sample Number: 890498.1-.4

Analysis Requested: HSL Acid/Base/Neutral Extractables (Surrogate Recovery)

Date Received: 05/26/89

Date Reported: 06/12/89

Client Ident:
Sample Location:
Sample Description: Water & soil
Sample Container: Glass bottle & jars
Field Prep: None

\# of Containers: 4

PARAMETER	890498.1	890498.2	890498.3	890498.4
2-Fluorophenol	7%	36%	15%	35%
Phenol-d5	9%	44%	19%	46%
Nitrobenzene-d5	40%	62%	23%	60%
2-Fluorobiphenyl	61%	95%	43%	93%
2,4,6-Tribromophenol	41%	93%	25%	72%
4-Terphenyl-d14	87%	86%	52%	68%

* MDL--Method Detection Limits (same units as the Results)
** REF--Reference as cited on the cover (first) page of this report.

HSL ACID EXTRACTABLES

PARAMETER	METHOD DETECTION LIMIT
2-Chlorophenol	3.3 ug/L
2-Nitrophenol	3.6 ug/L
Phenol	1.5 ug/L
2,4-Dimethylphenol	2.7 ug/L
2,4-Dichlorophenol	2.7 ug/L
2,4,6-Trichlorophenol	2.7 ug/L
4-Chloro-3-methylphenol (p-chloro-m-cresol)	3.0 ug/L
2,4-Dinitrophenol	42.0 ug/L
2-Methyl-4,6-dinitrophenol	24.0 ug/L
Pentachlorophenol	3.6 ug/L
4-Nitrophenol	2.4 ug/L
Benzyl alcohol	10.0 ug/L
2-Methyl phenol	10.0 ug/L
4-Methyl phenol	10.0 ug/L
Benzoic acid	10.0 ug/L
2,4,5-Trichlorophenol	10.0 ug/L

Detection limits for 890498.1 are listed above.
Detection limits for 890498.2 & .4 are 100X greater than above.
Detection limits for 890498.3 are 50X greater than above.

PARAMETER	METHOD DETECTION LIMIT
Acenaphthene	1.9 ug/L
Benzidine	44.0 ug/L
1,2,4-Trichlorobenzene	1.9 ug/L
Hexachlorobenzene	1.9 ug/L
Bis(2-chloroethyl)ether	5.7 ug/L
2-Chloronaphthalene	1.9 ug/L
1,2-Dichlorobenzene	1.9 ug/L
1,3-Dichlorobenzene	1.9 ug/L
1,4-Dichlorobenzene	4.4 ug/L
3,3-Dichlorobenzidine	16.5 ug/L
2,4-Dinitrotoluene	5.7 ug/L
2,6-Dinitrotoluene	1.9 ug/L
1,2-Diphenylhydrazine	11.1 ug/L
Flouranthene	2.2 ug/L
4-Chlorophenyl phenyl ether	4.2 ug/L
4-Bromophenyl phenyl ether	1.9 ug/L
Bis(2-chloroisopropyl)ether	5.7 ug/L
Bis(2-chloroethoxy)methane	5.3 ug/L
Hexachlorobutadiene	0.9 ug/L
Hexachlorocyclopentadiene	5.1 ug/L
Isophorone	2.2 ug/L
Naphthalene	1.6 ug/L
Nitrobenzene	1.9 ug/L
N-nitrosodimethlyamine	3.1 ug/L
N-nitrosodiphenylamine	1.9 ug/L
N-nitrosodi-n-propylamine	2.6 ug/L
Bis(2-ethylhexyl)phthalate	2.5 ug/L
Butyl benzyl phthalate	2.5 ug/L
Di-n-butylphthalate	2.5 ug/L
Di-n-octylphthalate	2.5 ug/L
Diethyl phthalate	22.0 ug/L
Dimethyl phthalate	1.6 ug/L
Benzo(a)anthracene	7.8 ug/L
Benzo(a)pyrene	2.5 ug/L
Benzo(b)flouranthene	4.8 ug/L
Benzo(k)flouranthene	2.5 ug/L
Chrysene	2.5 ug/L
Acenaphthylene	3.5 ug/L
Anthracene	1.9 ug/L
Benzo(ghi)perylene	4.1 ug/L
Flourene	1.9 ug/L
Phenanthrene	5.4 ug/L
Dibenzo(a,h)anthracene	2.5 ug/L
Indeno(1,2,3-cd)pyrene	3.7 ug/L
Pyrene	1.9 ug/L
Hexachloroethane	1.6 ug/L
Aniline	5.0 ug/L
4-Chloroaniline	5.0 ug/L
2-Methyl naphthalene	10.0 ug/L
2-Nitro aniline	10.0 ug/L
Dibenzofuran	5.0 ug/L

Detection limits for 890498.1 are listed above.
Detection limits for 890498.2 & .4 are 100X greater than above.
Detection limits for 890498.3 are 50X greater than above.

HSL VOLATILE ORGANICS by GC/MS
Method 624

PARAMETER	METHOD DETECTION LIMIT
Methylene chloride	2.8 ug/L
1,1-Dichloroethane	4.7 ug/L
Chloroform	1.6 ug/L
Carbon tetrachloride	2.8 ug/L
1,2-Dichloropropane	6.0 ug/L
Dibromochloromethane	3.1 ug/L
1,1,2-Trichloroethane	5.0 ug/L
2-Chloroethylvinyl ether	10.0 ug/L
Tetrachloroethene	4.1 ug/L
Chlorobenzene	6.0 ug/L
Trichlorofluoromethane	5.0 ug/L
1,2-Dichloroethane	2.8 ug/L
1,1,1-Trichloroethane	3.8 ug/L
Bromodichloromethane	2.2 ug/L
trans-1,3-Dichloropropene	5.0 ug/L
Cis-1,3-Dichloropropene	5.0 ug/L
Bromoform	4.7 ug/L
1,1,2,2-Tetrachloroethane	6.9 ug/L
Benzene	6.0 ug/L
Toluene	6.0 ug/L
Ethyl benzene	7.2 ug/L
Xylenes	10.0 ug/L
Chloromethane	8.0 ug/L
Bromomethane	7.0 ug/L
Vinyl chloride	6.5 ug/L
Chloroethane	7.5 ug/L
1,1-Dichloroethene	2.8 ug/L
1,2-Dichloroethene	1.6 ug/L
Trichloroethene	1.9 ug/L
1,2-Dichlorobenzene	10.0 ug/L
1,3-Dichlorobenzene	10.0 ug/L
1,4-Dichlorobenzene	10.0 ug/L
Acetone	500.0 ug/L
Carbon disulfide	20.0 ug/L
2-Butanone	30.0 ug/L
Vinyl acetate	30.0 ug/L
4-Methyl-2-pentanone	20.0 ug/L
2-Hexanone	20.0 ug/L
Styrene	10.0 ug/L
o-Xylene	10.0 ug/L

Detection limits for 890498.1 & .5 are listed above.
Detection limits for 890498.2, .3 & .4 are 10X greater than above.

PESTICIDE

PARAMETER

Alpha BHC
Lindane (gamma BHC)
Beta BHC
Delta BHC
Heptachlor
Alachlor
Aldrin
Atrazine
Heptachlor epoxide
Endrin
Endrin aldehyde
Endrin ketone
Dieldrin
p,p'-DDE
p,p'-DDD
p,p'-DDT
Endosulfan I
Endosulfan II
Endosulfan sulfate
Methoxychlor
Chlordane
Toxaphene

POLYCHLORINATED BIPHENYLS

PARAMETER
PCB 1016
Arochlor 1221
Arochlor 1232
Arochlor 1242
Arochlor 1248
Arochlor 1254
Arochlor 1260
Arochlor 1262
Arochlor 1268

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